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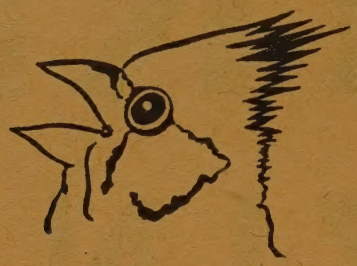

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Nature in Print

By HOWARD ZAHNISER

A PRIEST who had just shared one of Gustav Eckstein's curious observations in his College of Medicine laboratory at the University of Cincinnati "smiled in his mild way and commented: 'Politically one world may not yet be possible, biologically it always has been one world.'" Gustav Eckstein "on the side of that oneness" has recently fashioned into a fascinating and thought-suggestive volume two dozen reports of his "small scattered experiences" under the title *Everyday Miracle*—and it may be noted specially that the Miracle of the title is singular, referring to the supreme fact of Life, not to the many isolated manifestations of itself that seem so new to man's observation or so different from his imaginations as to be called by him miraculous. And this Miracle inclusive of all Life is likewise ever present; so far as man knows, continuous. *Everyday Miracle* is surely an apt title for a volume that uses its individual narratives, its specific episodes, "to illustrate, largely suggestively, some common theme in the lives of every one of us." It will be a welcome volume both to those who are seeking entertaining reading and to those who are in pursuit of a fuller knowledge of Life and lives.

The book's initial episode, for instance, concerns itself with a cat that on each Monday night went promptly at 7:45 to a bingo party, to sit on the window sill "apparently to see and hear the human species gamble and scream." The cat's performance is intriguing and amusing, yet the reader is promptly engrossed in contemplation of time. "There are time intervals enough," says Dr. Eckstein, "ticked off by the body and reported, very likely, to the brain-body actions with definite rhythms, rhythms that are maintained accurately often for long periods. The heart," he cites, "beats seventy-four times a minute or thereabouts. The lungs fill sixteen times a minute or thereabouts. Contractions of the stomach of the cat occur six waves per minute—the experimenter who first saw them said they were so dependably regular that he might use them to test his clock." The brain that is aware of these time intervals or conscious of these rhythms Dr. Eckstein calls "the great clock." He speculates: "One may suspect that only because it invented other less remarkable clocks and delegated the work to them did it partly lose its power."

Such are the uses Dr. Eckstein makes of his "small scattered experiences." He makes the acquaintance of a dog (slightly undersize) that has learned to walk upright on her hind legs, and from the details of this canine experience he speculates on the significance of human posture. In Spain he attends the preliminaries of a bullfight fiesta long enough to have a meditation on blood, expressed in a remarkable apostrophe in his book. In Greece he observes the storks and learns of how they join with storks that nest in other northern countries to migrate toward the Nile where, according to the chapter title, "All Storks Talk Egyptian." From these observations he suggests how the birds have "punctuated with warm-winged life the cold abstract idea of space in the brain of man"—space being in fact the co-subject of the chapter. At Orange Park, Florida, visiting the "world's greatest Primate Station," he gathers experiences reported in a chapter with the co-titles "Slightly Objectionable Relative: Evolution."

Thus there are reported in *Everyday Miracle* several excursions from the College of Medicine laboratory, but Dr. Eckstein himself has the impression that "essentially" the experience on which he based this writing "remained within these walls." Here seven zebra finches, ten generations of mongrel canaries, pigeons, mice, a macaw (which went home with Dr. Eckstein to his mother's) and even the cockroaches that came to join them provided Dr. Eckstein with the apprehensions of Life's meanings that are so expressed as to be the best enrichment of *Everyday Miracle.* A canary with remarkable longevity was noted to be an old codger who avoided the rush hours and the scenes of excitement. "Sex: Pigeon Couples" is the double title of one chapter. The delightfully whimsical yet thoughtful chapter that reports Dr. Eckstein's experiences with the cockroaches has the title "Reproduction: I Began to Call Her Minnie."

It is indeed a worthwhile book that has thus been created—one that has stood the test of reading aloud around a vacation cabin's fireplace, and has also afforded valued enrichments of thought in contemplative rereadings. One of its most inspiring intimations is that of the oneness of the Miracle, its recognition of the validity of mouse and cockroach as well as canary and pigeon, stork, and cat and dog. Here, as the publishers say on the title page, "Through intimate and sympathetic observation of animals, a brilliant scientist illuminates the miracle of all life."

The final chapter of *Everyday Miracle* tells of April, not only in the laboratory but also down below out of doors, where there are "families of thrushes, of robins, sometimes a flock of grackles, a wren, a chickadee, numerous communities of numerous varieties of sparrows, cardinals, an occasional pair of catbirds. (Also several cats.)" And Dr. Eckstein comments: "That down there is the great laboratory, this up here the small."

Fortunately, of course, it is the great laboratory that is available to all of us, a laboratory where there are many, many manifestations of the Miracle which have not yet been so intimately noted as those in Dr. Eckstein's "small" one. As in his microcosm, so also in the greater cosmos, the birds offer some of the most enticing opportunities for detailed observations. Most recent of the many helpful books that provide the layman with a general understanding of birds and their habits is Hal H. Harrison's *American Birds in Color*: *Land Birds.* As indicated, it deals only with the land species, although fortunately it includes the woodcock, Wilson's snipe, and upland plover from among the "shorebirds." It features particularly reproductions of color photographs, the title page carrying the line "With 192 Four-color Photographs." And there are as many more photographs reproduced in black and white. A remarkably large number of the photographs are from the author's camera, promoting a respect for his experiences that enhances the enjoyment of his sketches in words. Arriving at an Adirondack retreat early in August, the volume has had to await a complete reading by this reviewer, but its sketches of the cedar waxwing and the wood pewee have already added to the enjoyment of personal experiences with these species, and several other samples have whetted the appetite for the full reading that must come later. It is to be hoped that Mr. Harrison and his publishers have plans for a supplementary volume on the water birds and that it can be soon issued.

The author's "one overwhelming desire," he testifies in an introduction that is also an excellent essay on bird watching,

The Dove and I

By LOUISA BOYD GILE

Beside the rose bush crouched the dove
(Fair were the petals—soft his eyes)
And I, in silence, watched with love
The beauty Nature can devise.
Each curve, each color, blessed and blent
By an unstudied alchemy;
Rose-petal, rainbow feathers lent,
To satisfy a need in me.
Too often is pure grace ignored;
None watches where wings beat and drift.
How better can God be adored
Than in attention to His gift?

is that he may offer "sufficient inspiration to cause others to find in wild birds a fascinating, exciting, all-absorbing hobby; one that will prove physically, mentally, and spiritually uplifting." Birds, he affirms, are "alive, beautiful, elusive, mysterious, ever-interesting, ever-fascinating," and bird watchers he describes as forming a "great international fraternity" with an initiation fee that is simply an interest in birds. The spiritual value of the experiences with the birds he sees as possibly greatest in developing "a more tolerant, peace-loving, broader-minded individual."

And, Gustav Eckstein's experiences gained through intensive observations of a few species, a few individuals, suggests strongly the deeper depths of understanding, not only of birds but of all Life, that await those who will follow intently and persistently the path pointed out by Mr. Harrison.

Everyday Miracle. By Gustav Eckstein. New York and London: Harper & Brothers. 1948. 235 pp. $2.75.

American Birds in Color: Land Birds. By Hal. H. Harrison. New York: Wm. H. Wise & Co., Inc. 1948. 486 pp., with 386 photographs, including 192 in color, endpaper photograph, recognition charts, distribution charts, and index including "most often used" common colloquial and regional names. $7.50.

Nature Society Directory

Graphic evidence of the widespread interest in Nature in Great Britain is found in the 156-page booklet entitled "Directory of Natural History Societies", published at seven shillings, six pence by the Amateur Entomologist's Society, 1 West Ham Lane, London, E. 15. Organizations range all the way from the British Association for the Advancement of Science to, for example, the Beckenhamn County Grammar School for Girls Field Club. Many schools have active and valuable groups, and amateur naturalists have long made important contributions to biological knowledge in Britain. Any one interested in Nature and planning to visit Britain would be well armed with this booklet.

Country Cooking

The Countryman's Cookbook. By Haydn S. Pearson. New York. 1948. Whittlesey House. 311 pages. Illustrated. $3.00.

Grandmother Sanborn made corn chowder that was out of this world, and Aunt Agatha's recipe for fish chowder is something to be cherished—and tasted. Most of us have Grandmother Sanborns or Aunt Agathas in our gastronomic past, and fond memories of special dishes that they prepared. We will, therefore, enjoy Haydn Pearson's assemblage of country recipes—five hundred of them—and his preliminary comments on most of these. He has prepared a unique cookbook, one that he freely admits he found special joy in preparing.

British Birds

Making Friends with Birds. By Arthur F. Park. London. 1948. Chatto and Windus. Distributed in the U. S. by Macmillan. 216 pages. Illustrations by the author. $6.00.

This is a beautifully illustrated bird book by an accomplished bird student and photographer. The text is an informal story of his adventures with birds, of which he offers proof in the fine photographs. Practical advice on bird photography will be found helpful to those who hunt birds with a camera.

Green Carpet

The Earth's Green Carpet. By Louise E. Howard, Emmaus, Pa. 1948. Rodale Press. 258 pages. $3.00.

Through this volume runs the theme that Nature is best equipped to maintain her carpet of green upon the earth if man will only learn her secrets and use them to his own advantage. In other words, it is a book that, by contrast, raises serious question as to the wisdom of the chemical treatment of lands. The author is the widow of the late Sir Albert Howard, international authority on agricultural problems.

Another Bent Volume

Life Histories of North American Nuthatches, Wrens, Thrashers and Their Allies. By Arthur Cleveland Bent. Washington, D. C. 1948. Smithsonian Institution. 475 pages, with 90 plates. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. $1.75.

This is the latest volume in the great series of life histories by Mr. Bent. It follows in form and treatment the fifteen volumes that have gone before and which, together, constitute an invaluable and incomparable ornithological reference library.

Pronghorns

The Pronghorn Antelope and Its Management. By Arthur S. Einarsen. Washington, D. C. 1948. The Wildlife Management Institute. 238 pages. Illustrated. $4.00.

This is the latest addition to the growing series of books being published by the Wildlife Management Institute. As with other volumes, this one brings together the story of a species, covering its history and historic distribution, its present status, its life history and characteristics, its relation to man and the problems of its maintenance as a member of our surviving fauna. The author is the leader of the Oregon Cooperative Wildlife Research Unit. He writes interestingly, often with special charm when he finds himself freed of presenting scientific data.

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To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and Devoted to the Practical Conservation of the Great National Resources of America

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"Felted Footballs"

This was the title of a brief article in our June-July issue, and the author observed that these strange formations, "so far as can be ascertained, are neither named nor accounted for." Neither the author nor ourselves delved deeply enough into literature, for these globular or spherical objects have been accounted for, and variously named. W. L. McAtee, observing that bookworms *do* have great value, cites a small bibliography about these objects, which indicates that they are formed through the action of waves and "are variously composed of algae, and other water plants (or parts of these plants), needles of coniferous trees, debris from chestnut burs and cones of evergreens, and no doubt of other vegetable substances. . . ." Recently some balls formed of salmon bones were made by the waters of the Karluk River, Alaska. Further, and by curious coincidence, the June, 1948, issue of *Scientific Monthly* contains an article about the balls collected from the shores of Little Borax Lake, California, which was where our author observed and photographed them. Some of these balls having been brought to him, Dr. E. O. Essig of the University of California determined to get at the bottom of the matter, and the results of his investigations are reported in *Scientific Monthly*. He finds that the balls were formed almost entirely from small seed-stalks and, possibly, broken stems of "ditch grass", *Ruppia maritima*, woven or matted together by the action of the waves and deposited on the shore of Little Borax Lake.

Quetico—Superior

All who read Sig Olson's fine article, "Voyageur's Return", in the June-July, 1948, issue of *Nature Magazine* will be happy to know that progress toward saving this area was greatly furthered when President Truman signed the law authorizing a half-million dollars for the purchase of private holdings within the region. Much remains to be done to assure the future wilderness integrity of the Superior country, but further exploitation can now be checked and steps taken to restore exploited areas to their natural state.

Wildlife Conference

Alarming effects of the increasing demand of a growing human population on the limited supply of natural resources will be stressed in the program of the Fourteenth North American Wildlife Conference to be held in Washington, D. C., March 7 to 9, 1949. The meeting, which brings together conservationists from all over the North American continent, is being held, as in the past, under the sponsorship of the Wildlife Management Institute. General and technical sessions will be held.

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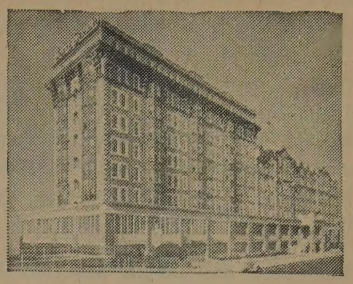

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THE THRILL OF A LIFETIME

By H. F. GULICK

One pleasant summer afternon found me paddling alone on a Vermont lake. Suddenly I heard distress sounds overhead. The squawks were of real terror. Looking up, I saw the two large eagles —long a familiar couple to us—who live at the foot of a steep hillside.

Apparently the parents had told their two children that it was time to try their wings, but the distress cry of one of the small eagles showed great fright. The youngster had utterly lost his courage and was falling, tipping one way and then the other in his descent, wholly out of control.

Instantly the parent came to the rescue, and the frightened fledgling was soon riding calmly on the mother's back. Hardly had a minute passed before I saw the mother drop away and the young eagle was flying confidently with the others toward the tall pines across the lake.

What did the mother say, in eagle language, to her frightened child? Was it, "You are no little chicken! You are an eagle's son! Try again! Here we go!"

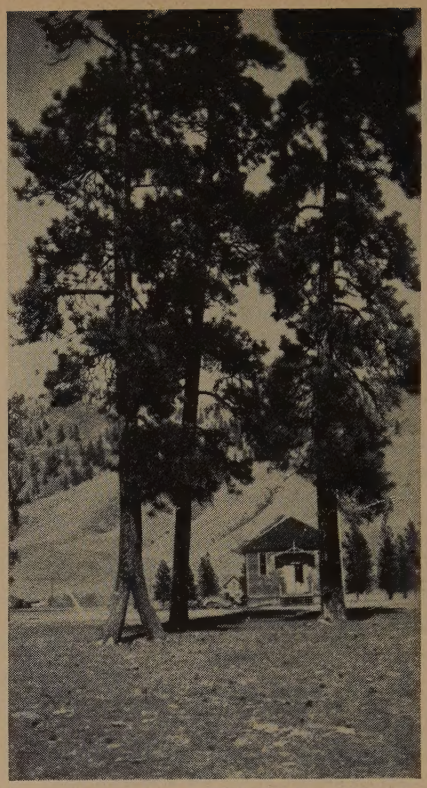
I thought of the word in the good Book, "As the eagle stirreth up her nest, fluttereth over her young, spreadeth abroad her wings, taketh them, beareth them on her wings, so the Lord— —."

Osprey Tragedy

For three summers passengers crossing Chesapeake Bay from Claiborne to Romancoke have watched with interest the pair of ospreys that have raised successive families in a rough nest built on piles beside the ferry dock. In July a story by Frank Woodfield in the *Baltimore Sun* increased the number of watchers of the nest. Then tragedy struck. The mother was shot in the beak, tried desperately to feed her young, and then disappeared, apparently to die. The male bird took over, and did quite well until the young were ready to leave the nest. Apparently they needed a mother's advice, for two of them landed in the water and had to be rescued and hand-fed by Percy Thomas, watchman for the ferry company. He reared them successfully. Meanwhile indignation ran high and a state trooper confessed to the shooting. He admitted it was a thoughtless and inexcusable act, and accepted the fine and reprimand as a proper lesson.

Motion Picture Contest

Renewal of its 16mm. motion picture contest for films dealing with pets, birds, wildlife and domestic animals is announced by the American Humane Association, 135 Washington Avenue, Albany 6, New York. The contest closes March 31, 1949, and full details may be obtained by writing to the address above.



PHOTOGRAPH BY T. SHERBININ

SYMBOL OF UNITY

By H. B. BINNY

The two yellow pines here pictured were tied together by Okanagan Indians of southern British Columbia and the State of Washington, and have grown together in perfect fusion. They stand as symbols of unity, for the Indians started the fusion, which Nature finished, as a practical sign of Indian recognition of the Washington Treaty between Canada and the United States establishing the 49th Parallel as the boundary between the two countries. The union of the two trees, which the years have made so perfect, was intended to signify that the tribes, although separated by the white man's boundary, were still and always united in spirit. The trees are located at Midway, British Columbia, close to the International Boundary.

THE MISSION OF THE MEADOW LARKS

By BERTHA P. HILL

It was late spring on the Utah desert, part of which our Irrigation and Colonization Company was trying to make "blossom as the rose." That phase of the experience supplied its own compensation for much that was lacking otherwise, but there were two things that never failed to inspire a response of joy and gratitude.

One was the starry heavens at night, which, completely unmarred by any artificial light, were unspeakably glorious. At times the stars seemed to come so close in their scintillating brilliance one felt that they only had to reach up their hands to touch them. In the full moons of July and August, distance was reasonably measurable, and mountains seventy-five miles away tempted you to try a more extended outlook from the heights. Only in the clarity of the desert atmosphere after an evening shower can a lunar rainbow shine forth in such resplendency. On the desert any time during the year, after daylight has completely faded from the sky, the splendor of the universe is spread forth.

The other especially compensating factor was the meadow larks. They left us only for a very short period during the severest cold and always were back before the frost had left the ground. It was well worth a vigilant watch to catch a pair in the early morning, as occasionally happened, one on each rail of the bridge-approach to the office, pouring forth their hearts in a recitative of liquid music that was breath-taking.

One day I was caught as an unwilling listener to a controversy which called forth a torrent of such vile invective that I escaped from it aghast and utterly shaken. My one desire to avoid for the time any contact with another human being led me straight out into the desert. A walk of some five miles took me to the reservoir whose sloping bank afforded a comfortable place to rest. My thought was still clouded by the echoes of the hour before, when I was suddenly stirred by the voice of a meadow lark perched on a fence post a few yards away. Presently another answered, and before I realized what was happening meadow larks were dropping down on the brush over an area perhaps fifty or sixty feet in front of me. I counted twenty-three birds at one time and there may have been a dozen more. Their songs poured forth by ones, twos and threes, and in chorus—a God-sent message of melody which substituted for the rankling protest and resentment a paean of grateful praise that such a thing could happen, for it is conceded that meadow larks do not usually congregate in flocks. But they did that time—a solace for a hurt soul.

After about ten or fifteen minutes they went as they came, by ones, twos or threes, in the various directions whence they arrived. And when I left it was not as I came, but like the birds themselves with a song in my heart.

Negro School Wins

Making an outstanding transformation of its grounds, Gallilee School, a simple, one-room Negro school near Jackson, Mississippi, won top honors in the National Garden Institute's rural school beautification contest. Electricity having recently been installed in the school, the pupils can now enjoy a Motorola radio-phonograph combination as a result of their improvement success. Second prize went to the Pleasant Hill School of Marshall, Illinois, and third to Spout Spring School of Spout Spring, Virginia.

Contents Noted

ALTHOUGH widely publicized in sporting and conservation magazines, with printed forms to be clipped and filled out, only one duck hunter in one thousand made a return to the Fish and Wildlife Service of his migratory waterfowl kill in 1947. There were more than two million licensed duck hunters, yet only 1962 returns were made, a percentage so poor as to be statistically worthless. This percentage of response and cooperation does not accord well with the figure of "good sportsmen" among duck hunters, which Nash Buckingham, chairman of the Waterfowl Committee of the Outdoor Writers Association of America, sets as seventy percent of those who go into the duck blinds annually.

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WORD coming from Miss Pearl Maynard of West Newton, Massachusetts, that she is disposing of the remainder of her father's Nature books contains a bit of nostalgia for us. As a boy the route of our Saturday hare and hounds chase, or weekend Indian "hunt" through the wooded area now a golf course, usually led us past the home of Charles Johnson Maynard. We knew who he was and that he was a bird man, and we recall two or three glimpses of his collections, but we were heedless, then, of this pioneer in Nature education. As far back as 1863, Charlie Maynard, as grandfather called him, conducted Nature classes and wildlife walks. He collected widely, wrote and illustrated and printed his own books, coloring his pictures by hand. He was a catholic naturalist in his interests, and although his books have been superseded today by more modern works, they are fascinating as collector's items for Nature libraries. We wish now that we had been more alive to our opportunities, and, whether hare or hound, paused longer at the Maynard home, where his daughter still lives.

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WHEN migratory hawks and eagles move southward again this year, floating on the air currents of the Kittatinny Ridge, they will pass a spot that once blazed with gun-fire at the birds' passing. This is Hawk Mountain Sanctuary, unique in its position in bird protection and Nature education. There comes to hand the tenth annual report of the Hawk Mountain Sanctuary Association, which reviews the history of the creation of both the Association and the Sanctuary. It seems to us that this is an important conservation document, a report of tangible and significant accomplishment in the field of wildlife conservation. We hope that anyone not already informed about the work of the Hawk Mountain Association will write for a copy of the report to Mrs. C. N. Edge, 767 Lexington Avenue, New York 21, N. Y.

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WE like the story that Ed Graham, chief of the Biology Division of the Soil Conservation Service, tells to illustrate interrelationships in Nature. A farmer complained that he no longer had ducks on his pond. He was told that that was because the skunks were being trapped, which did not make much sense to the farmer. However, he saw the point when it was explained that the skunks dig up the snapping turtle eggs and eat them, but with no skunks there were more snappers than there was available food for them. So they preyed on the ducklings, and the parent ducks, unwilling to nest where they were molested, departed for safer ponds. Nature relationships are as simple as that, many of them, but man keeps on upsetting them with ignorant or superstitious faith in killing this or that form in the belief that he is solving something.

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DOUBTLESS those local boosters who thought it appropriate to add a few artificial feet of stature to Mount Rainier, and thus move it higher on the list of high peaks, were acting on impulses of pride and local patriotism. We are happy to note, however, that the Superintendent of Mt. Rainier National Park rallied his rangers about him, barred the way and emphatically banned the venture. And we hope that the group which, no doubt indignantly, turned back now realizes that its project was more than a little bit silly.

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RANDOM Notes on a Peripatetic Vacation: Virtually billboardless Vermont is the loveliest state in the East, maybe anywhere . . . Pennsylvania has the finest back roads, billboardless also . . . Maryland's main highways are largely antediluvian and horribly cluttered with billboards and roadside slums . . . New Hampshire has sold a lot of her landscape down the river, and Massachusetts has slipped grievously into the clutches of roadside desecration after having had the opportunity to be an example to the nation, which Vermont now is . . . The Adirondack Preserve is a welcome escape in New York, except from some heterogeneous and ugly summer settlements . . . Song and insectivorous birds seemed definitely fewer in places where they should have been, convincing us anew that the wholesale and indiscriminate use of high-powered insecticides is a greater ecological menace than we now realize . . . Hanover, New Hampshire, with Dartmouth; Amherst and South Hadley, Massachusetts, with Amherst and Mt. Holyoke, respectively, are perhaps the loveliest of college towns. (We'll hear from this, no doubt.)

R. W. W.

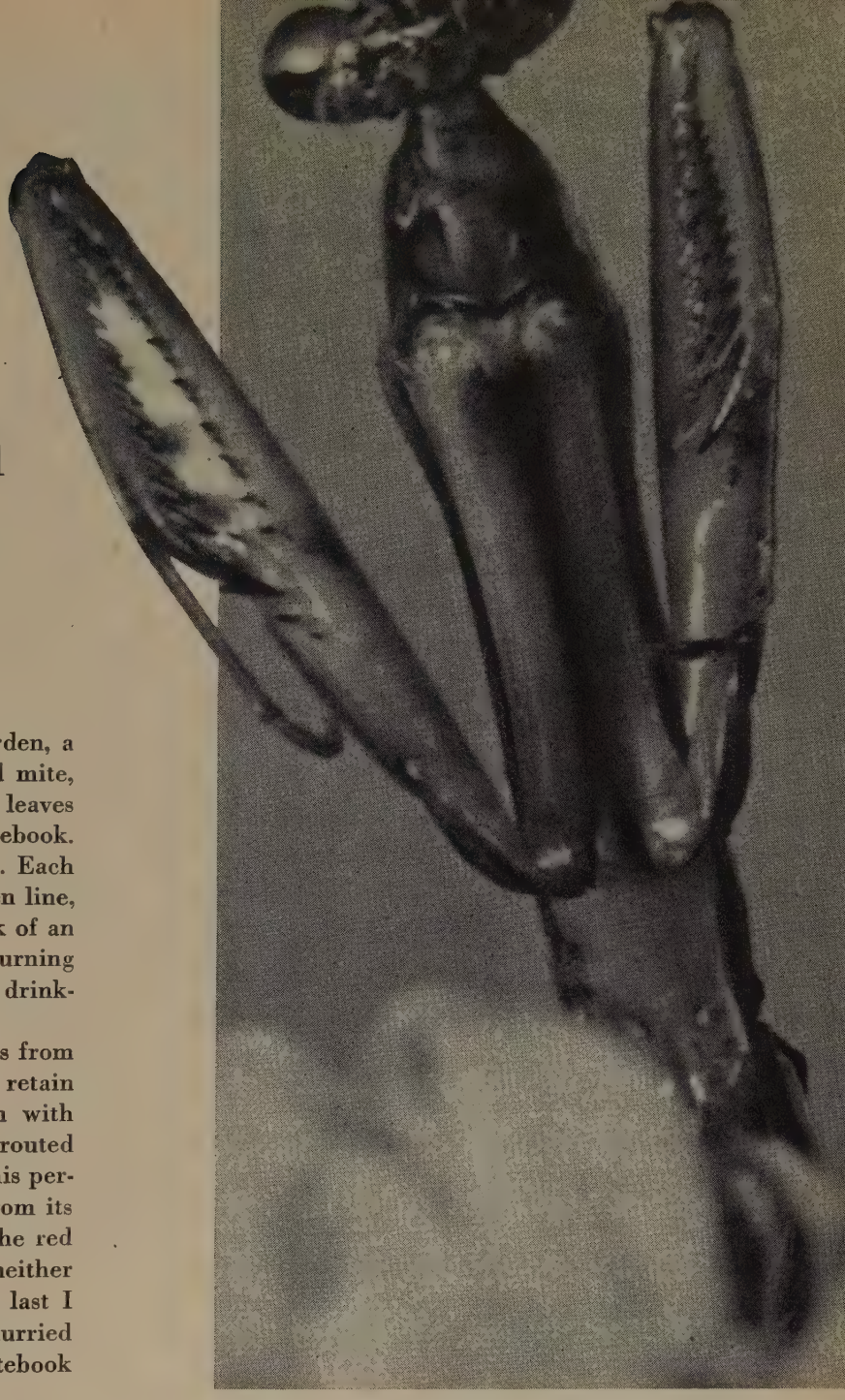
Insect net ready, Edwin Way Teale stands in the midst of his insect garden waiting to capture a specimen that will yield some secrets through study, or will pose for his versatile camera.

This is the third of three articles that will appear as chapters in the book DAYS WITHOUT TIME, shortly to be published by Dodd, Mead. In this Edwin Way Teale explores further in his Insect Garden, and finds many examples of—

The Strength of the Frail

By EDWIN WAY TEALE

Photographs by the Author



A praying mantis reared up. These insects are able to survive injuries that would be fatal to larger and stronger animals.

UNDER an old apple tree in my Insect Garden, a curious thing has happened. A tiny red mite, dropping through the air from the leaves above, has landed on the open page of a notebook. It runs over the paper in curves and curlicues. Each time it comes to the wet ink of a freshly written line, it pauses for a long time as though on the bank of an impassable river. Then I notice its body is turning darker—is losing its brilliant red. The mite is drinking the carbon ink.

Eight times it stops, and eight times it drinks from the black stream of the ink-trail. Only its legs retain their original color. Its round body, swollen with carbon ink, looks like a period mark that has sprouted legs and is running about over the page. Yet, this perambulating period mark shows no ill effects from its intemperance. The black mite is as lively as the red mite had been. The ink in its system has neither slowed it down nor upset its digestion. When last I saw it, it was following the curlicues of its hurried trail along the edge and over the edge of the notebook with as much energy and speed as before.

Mites imbibing ink, cockroaches consuming glue, termites eating wood, beetles stowing away mustard plasters—these are only a few of many instances of small creatures that thrive on what would prove a deadly diet for larger animals. Part of the strength of the frail, the strength of the insects and the other minutiae of the animal world, lies in the bewildering variety of their diet. Because their feeding habits are so varied, because the amounts of food they require are so small, because some of them—like the mayfly and the great American silk moths—live without eating during their adult periods, such creatures are able to endure privations that would kill far larger and far stronger animals.

Between a thumb and forefinger we can crush a ladybug or a butterfly. We are giants in comparison. Yet, in numerous ways, the frailer, smaller creatures of the earth possess other, special kinds of strength. They survive extreme and sudden changes in temperature and air pressure. They retain life in spite of great injuries. They reproduce with a fertility unequalled among larger animals. They are uninjured by long falls. And they possess the strength of senses that in many are specialized and abnormally keen.

Katydids can hear up to 45,000 cycles per second. This is far above the range of the human ear. Honeybees can see ultra-violet light, invisible to our eyes.

A lace bug on the back of a sunflower. This insect is really scarcely three-sixteenths of an inch long, but it possesses strengths that many large animals lack.

That scourge of the tree-boring *Tremex* larva, the ichneumon fly, *Megarhyssa* lunator, can smell its prey through as much as two inches of solid wood. And laboratory researches have shown that the legs of a monarch butterfly are 200 times as sensitive as the human tongue in the detection of sweets. The lowly bedbug has such an amazingly acute sense of temperature that it can detect a difference as slight as one degree Centigrade. Many of the ground-runners, such as ants and wolf spiders, are particularly sensitive to vibrations.

In *The Naturalist in La Plata*, W. H. Hudson tells of seeing a large, grayish, wolf spider running along beside him as he was riding across the pampas of Argentina. He struck at it with his whip. As the lash bit into the earth a few inches from it, the wolf spider leaped upon it and ran along the whip toward the rider. Dr. Willis J. Gertsch, spider authority at the American Museum of Natural History, not long ago gave me an explanation for this surprising reaction of the spider. All wolf spiders are sensitive to vibrations in the ground. Tap a pair of small forceps on the sand when a wolf spider is near and it will immediately run toward the spot. This exceeding alertness of the Lycosids aids them in detecting the presence of their prey. Thus it was not any intention of attacking the rider that caused Hudson's spider to leap upon the whip; it was the vibrations produced by the lash as it struck the ground nearby.

Another curious example of a creature highly sensitive to earth tremors was related to me, not long ago, by one of the scientists of the U. S. Bureau of Entomology. When his yard, one summer, became infested with moles, a friend in Washington, D. C., suggested a singular remedy. The scheme, which he tried, was to whittle out a number of small wooden propellers with one blade slightly longer than the other. These were mounted near the top of sticks that were thrust into the ground. The breeze, whirling the unbalanced windmills, produced a constant vibration that was carried down the sticks to the earth. Within a few weeks, the scientist told me, all the moles had left his yard.

Fifty feet or so north of the tree where the red mite fell from the leaves, seventeen sunflower stalks bear their great flat flowers rimmed by petals the color of rich butter. As thick as dust on the back of these petals, and on the under side of leaves of the plants as well, are colonies of minute insects. The largest of the winged adults are hardly three-sixteenths of an inch in length. I move my pocket magnifying glass above them and they expand into delicately formed, fantastically beautiful little creatures. The veins of their oddly shaped wings are thickened so they seem formed of dainty lace. Curving plates, extending out from either side of the body in front of the wings, are similarly marked. These most beautiful of all the tiny creatures that drink the sap of my Insect Garden plants are the lace bugs, *Corythuca arcuata.*

I swing my glass away and the lace bugs return to their minute forms once more. They seem so small, so frail, so filmy; yet these delicate-appearing creatures are able to endure temperatures that would bring death by freezing to far larger, stronger animals. Hidden under bark and in fallen trees, some lace bugs overwinter in the adult form. This ability to endure great extremes of temperature is an important part in providing the strength of the frail.

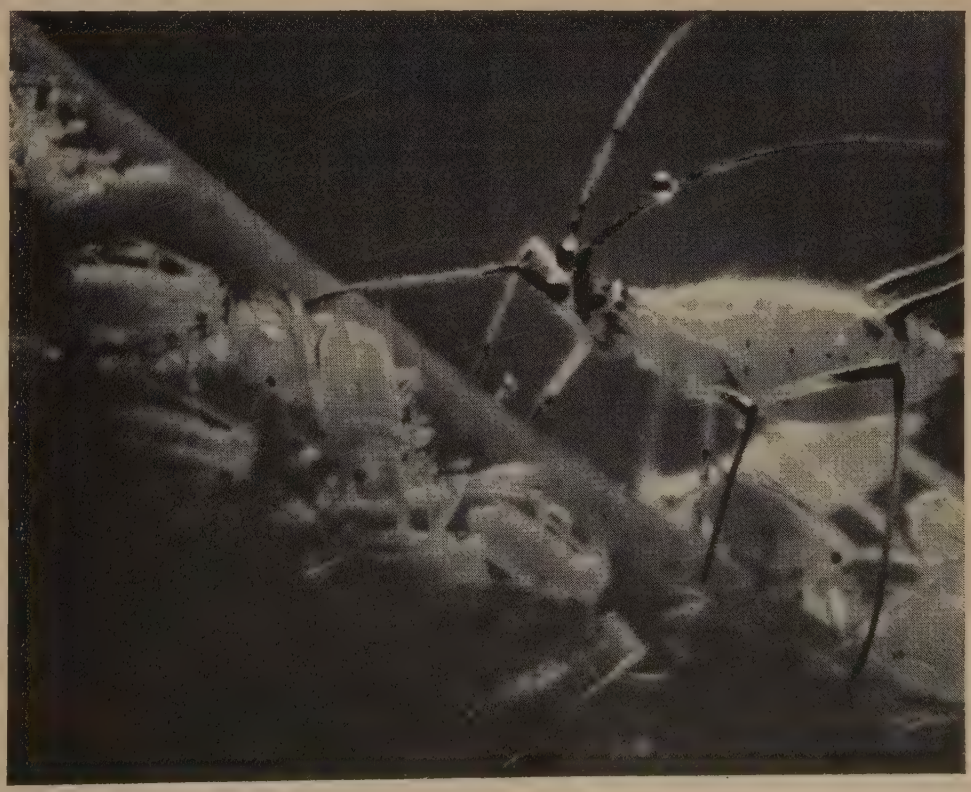
A tattered monarch butterfly in autumn. Even though its wings are broken and frayed, it is able to survive.

One winter, a dozen *Polistes* paper-making wasps hibernated amid trash at the bottom of a blue box that was often covered with ice and snow at my Insect Garden. On a day of thaw, in February, I found them moving sluggishly about. When it turned cold again, they clung in position without moving. Thus they bridged the gap from fall to spring. High in the Rockies, small butterflies live through sleet storms, hiding under rocks until, a few days later, warmer weather melts the ice and they can fly about the slopes once more. Entomologists have noticed that such mountain insects are usually dark in color. This enables them to absorb a maximum of heat from the sun's rays. Fish, incidentally, often display amazing immunity to freezing. Certain species may be frozen in solid ice for weeks without injury. I have heard of fish being jerked from the water in the far North, when the temperature stood at forty-five degrees below zero, and being frozen stiff in the open air. Weeks later, after hanging like pieces of wood outside a cabin, they have revived when brought indoors for cooking.

Every fall, I am surprised to observe frail gnats, creatures so small, so light, so fragile that we watch them, as Keats says, "borne aloft or sinking as the light wind lives or dies." I am surprised to see these insects among the last abroad. In spite of their seeming weakness, they have a hardiness that enables them to keep active far into the harsh, later days of autumn.

Other small creatures, water striders, snow fleas, tiny spiders, are out on mild days even in midwinter. In his classic experiments with fruit flies, Dr. Frank E. Lutz showed they exhibit unbelievable resistance when subjected to sudden changes and physical strains such as they would never meet in normal life. He reduced the air pressure within a bell jar until it was equivalent to that seventeen miles and more above sea level. Twenty-four times in four hours, ten flies were subjected to this rarefied atmosphere, alternating with normal sea-level pressure. Yet two of the flies lived and bred afterwards.

One winter, an oak tree near my Insect Garden was cut down for firewood. The interior of its trunk was riddled with the galleries of carpenter ants. I brought home some of the insects, which I found huddled together in hibernation, and placed them under a desk



With aphids their fertility is their strength. These plant lice increase with such rapidity that they survive despite their comparative defenselessness.

lamp. The smallest ants were the first to revive. This is something that I might have expected, because the smaller the creature the greater the surface area in proportion to the body bulk. This fact accounts for another feature of the strength of the little. They can sustain great falls without suffering the slightest injury.

An ant can fall from the top of a skyscraper and land unharmed; cicada nymphs, hatching from eggs laid in twigs of trees, simply let go and are buoyed up by the air as they fall to the ground. The red mite that started this train of thought ran about the page of my notebook as soon as it struck the paper. Its fall for a distance many thousands of times its own height was taken as a matter of course. A man falling from four or five times his height may be crippled or killed. As size increases, the proportion of body-mass to surface-area increases. Thus it is that the smallest animals are cold-blooded, the largest warm-blooded. The greater the surface area in proportion to mass, the more rapidly body-heat is dissipated. We, with a smaller proportion of surface to body-mass, can be warm-blooded. The insect cannot. But the condition that makes this impossible does make possible its escape from death or injury when it falls from a height.

The mouse, one of the smallest of the warm-blooded animals, lives near the dividing line. It can be warm-blooded, and, at the same time, its surface area is proportionately large enough to slow down its speed in a long fall.

In the heart of New York City, near Radio City, there is a vacant corner lot with a high wire fence on two sides and the brick walls of buildings on the other two sides. Here, one day, a friend of mine saw a dozen men and women peering through the mesh of the wire fence watching something inside. In the corner where the brick walls met, a cat had discovered a mouse hidden beneath a mass of wind-blown papers. It would pounce first in one place then in another as the mouse scurried about under the papers. Finally, its quarry reached the nearest wall and began climbing straight up the face of this precipice of brick.

While the cat waited below, and the people watched outside the fence, the mouse pulled itself higher and higher. Mounting upward brick by brick, it moved more slowly, searching for claw-holds. It was more than two stories above the ground when it lost its footing and plunged downward. To everyone's open-mouthed amazement, instead of lying stunned or dead when it struck the ground, the mouse scampered off and later made good its escape, much to the pleasure of many observers.

At Cornell University, another mouse sustained an even more spectacular fall. Within a few days of giving birth to a litter of young, a mother white mouse fell three stories from the roof of a building to a concrete walk below. She not only escaped death but later gave birth to a full litter of uninjured and normal baby mice. There is factual basis for the old saying that a mouse can fall down a mine-shaft unharmed while a donkey will be reduced to a grease-spot.

A fit companion for these mice is a pet tree frog that lived in a room on the tenth floor of an apartment house in Philadelphia. One summer day, by mistake, the frog leaped out of an open window. It found itself in thin air eighty feet above the ground. A few minutes later, it was discovered hopping about on the ground below with no more serious injuries than two broken toes.

Among the insects, injuries that would bring instant death to the larger animals are sometimes—temporarily, at least—almost ignored. A conehead grasshopper, with its head picked off by a chicken, kept on stridulating, continuing the music produced by its wings. A male praying mantis, hours after it had been decapitated, reared up and lifted its wings in the so-called specter pose when it was touched. A female of the silk moth, *Bombyx mori*, will continue laying its eggs even after its head has been severed from its body. I have seen an ant, with its entire abdomen gone, running along as though possessed of a normal body. Many young insects, if they lose a leg, simply grow another one. Monarchs sometimes fly about my garden in fall with wings tattered to shreds. Injuries of many kinds, injuries that would be mortal to animals of far greater physical strength, are often a matter of relative unconcern for the small and the frail. This, too, is part of their strength, Nature's endowment to assure perpetuation of the species.

But above everything else, above their ability to withstand long falls, severe injuries, extreme changes in temperature and air-pressure, above their amazing powers of digestion and the variety of their menu, above the benefits of their specialized and abnormally keen senses, there is another factor in the strength of the frail. This is their incredible fertility, the rapidity with which they reproduce. It reaches its peak in the smaller, weaker, the most defenseless of the insects.

The green flood of the plant lice, the emerging clouds of the mayflies, the devouring hosts of the locusts—these are symbolic of insect fertility. Two summers ago, so vast were the swarms of mayflies along the shore of one eastern lake that railway trains were stalled and traffic disrupted. Not only are numbers vast among the small, frail creatures of the earth, but the wheel of life whirls with added swiftness. Generation follows generation in rapid succession. Because of this, evolution is speeded up, the smaller creatures are better fitted to adapt themselves to meet the changing conditions of life. Thus, in numerous ways, advantages offset the physical weakness, the individual insignificance, of Earth's smallest animals. This is Nature's scheme, intricate and ever fascinating to those who know the wild.

The hog-nosed skunk of the desert is a striking creature, a little larger and heavier than the eastern striped skunk. This desert-dweller is white on the back and almost to its nose, and its strangest features are the long, curved, front claws and the broad, piggish snout.

Cactusland Creatures

By W. J. SCHALDACH, Jr.

Illustrations by the Author

IN THE dim light of the new moon, strange, elfin forms danced among the greasewood bushes. Crouched behind a giant cactus, I rubbed my eyes and looked again, wondering if the desert night had made me dizzy. Across my mind, remembered tales of leprechauns and "little men" flickered in rapid succession as I watched the antics of the tiny creatures.

Suddenly I recalled that I was supposed to be a naturalist, and I knew then what the fairy figures were—kangaroo rats playing and feeding on the Arizona desert. But the dry facts of the animals' names and shapes could not dispel the romance and eerie mystery of those tiny forms weaving a minuet in the gloom.

When my cramped limbs could take it no longer, I arose and stretched. The little dancers scattered into the bushes with great flying leaps. Cautiously, I picked my way back through the cactus and thorny chaparral to our small camp.

My brother and I had pitched our camp on a lonely stretch of desert near the foothills of the Santa Catalina Mountains of southern Arizona. We were working for a museum, collecting and studying the desert dwellers as we lived among them. Because we were New Englanders, with no experience of the Southwest, the strange and exotic animals of the arid country thrilled us deeply. Pictures and dry descriptions of these desert sprites had prepared us for their general appearances, but the living creatures delighted us.

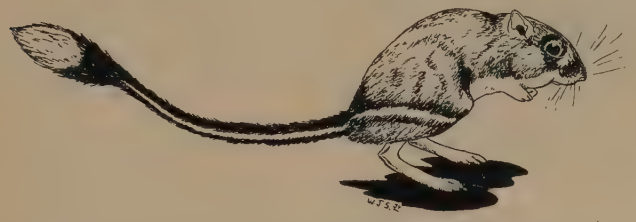
The little spotted skunk is hardly bigger than a half-grown house cat, and it was plentiful about the naturalists' camp.

There was often no need to go looking for the animals; they sometimes wandered into camp by themselves. We came abruptly out of a sound sleep one night, awakened by a loud banging and clattering noise in the vicinity of the pots and pans. After groping about wildly in the dark, we finally snapped on a flashlight. There was a large skunk, plumed tail waving, placidly poking around for a possible tidbit. His eyes shone like topaz crystals for a moment as he looked at us. Then, with a loud sniff, he was gone.

Later I caught one of these animals for the collection. He was not like the striped eastern skunks, being a little larger, heavier, and colored differently. His coat was all white on the back almost to the nose, with black undersides, belly and feet. His strangest features were his long, curved, front claws and his broad, piggish snout. The desert people called him the "hog-nosed" skunk. By daylight, he was an inoffensive beast, but he had certainly seemed bigger and more menacing by the glare of a flashlight at midnight.

This camp was in one of the skunkiest areas we have ever seen. Besides the hognosed gentlemen, there were a few of the

desert variety of the well-known striped skunk. But the most interesting were the little spotted skunks, hardly bigger than a half-grown house cat. These pretty animals were plentiful around our camp. Few nights passed without one or two attempts at discouraging these visitors. This was usually done by shying a stone in the general direction of the offenders and hoping devoutly that it did not connect.



Kangaroo rats are interesting desert-dwellers that have a special built-in stabilizer, or gyroscope, in the ear region. This enables them to keep on even keel during their jumps, which provide their best means of escaping from the natural enemies.

Once we did hit one, and the resulting aroma forced us to break camp in a hurry.

The desert people had warned us about these little skunks. They called them "hydrophoby cats," and claimed they were as deadly as a rattlesnake because they carry rabies. A few spotted skunks have been known to be rabid, and, also, to bite other animals, and even men. But we decided that the chances of being bitten by a mad skunk were even less than

Pack rats of the desert lived up to their reputation for accumulating things. One of them discarded a bit of cholla cactus in favor of one of the collecting traps selected from a pile of these.

being struck by lightning; that it certainly was nothing over which to lose any sleep.

When I sleepily turned a flashlight on the usual disturbance one night, a new animal stood blinking in the light. My first impression was of a great pair of glowing, red eyes, with a vague ringed tail in the dusk behind them. Seizing the shotgun, I fired and collected our first ring-tailed cat. This animal is related to the raccoon tribe. But, instead of the typical chunky, raccoon body, the ringtail has a low-slung, slender chassis like a marten. Its big eyes and large, erect ears give it a most alert appearance.

The smaller creatures of the desert were a confusing lot. They came in all shapes and sizes, from diminutive animals the size of shrews to animals the size of rats and large squirrels. The first of the smaller mammals that we met were the pack rats.

Near camp, there were several large nests made by these rats. They were large, rather haphazard affairs, built of dead cactus ribs, stray sticks, and dried cactus leaves and spines. Some of them were well defended. The animals had collected the round, densely spined joints of the cholla or jumping cactus and had placed them around the entrance holes of the nest. How the rats can lug these cholla clumps without getting stuck is a mystery, yet none of the pack rats we examined had any spines in their anatomy.

One night I had a pile of mouse traps near our sleeping quarters, traps I had not had time to set out that afternoon. In the morning, the traps were all scattered about and a large cholla clump lay near them. One of the traps was missing. I remembered the classic advice to campers in pack rat areas and

Pocket mice are equipped with external pockets along each cheek. These are fur-lined and commodious, and when the desert mouse has these full it looks as though it had a fine case of mumps.

went on a nest hunt. On a nest about a hundred yards from camp I found the missing trap.

What had probably happened was that the pack rat had been returning to its nest with a mouthful of cholla when it had found the pile of traps. Fascinated by the bright metal parts, it had dropped the cactus joint, looked through the pile, and picked up the trap it wanted. It must have been quite a trip back to the nest for the animal, because these traps are special collecting devices, larger and heavier than the ordinary mouse trap. This habit of dropping whatever it is carrying, and taking something it likes better, has earned the name "trade rats" for these desert swappers.

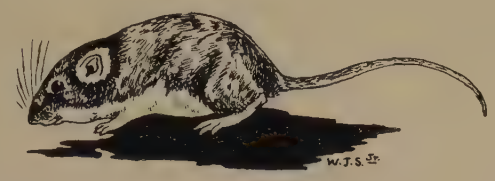
The most interesting of the smaller mammals, to us, were the rat- and mouse-like creatures that had provided our introduction to the desert life that first evening in the greasewood brush. These little rodents, kangaroo rats and pocket mice, swarmed in the sand and gravel of the desert floor.

An interesting adaptation, common to both pocket mice and the kangaroo rats, is the external pocket along each cheek, fur-lined and commodious. A

number of times I trapped pocket mice with their cheeks so crammed with seeds that they looked as though they had the mumps. This pocket or pouch is their market bag, or, as New Englanders say, their "ketch-all."

The kangaroo rats have these pockets, too, but their most valuable possession is an apparatus in the ear region, not completely understood by science, that acts as a combination compass and gyro-stabilizer. My brother came across this by accident one day. Bob had been trying for a long time, with small live traps, to get a couple of kangaroo rats for pets. Then one day he found one huddled up in the back of a trap, obviously resentful of its captivity.

Back at camp, it acted strangely, not at all like the vigorous leapers I had seen that first night amidst the cactus. The poor creature could not make a decent jump. When it tried to leap, it fell off on one side or landed helplessly on its back. Finally, realizing that something was wrong, Bob killed it. Dissection revealed a cactus spine that had been driven through one side of the animal's skull, penetrating the ear bulb. This had probably injured its middle ear region and upset its balance.



Baird pocket mouse, and, below, a grasshopper or scorpion mouse, one of the few rodents to become exclusive meat-eaters.

These greatly inflated ear bulbs of the kangaroo rats are unique organs developed through ages of leaping existence. They serve two purposes, besides the main purpose of keen hearing. The first is balance. These rats are among the best leapers in the world, because long, erratic jumps are their only defense against the swift killers of the desert. But, in jumping, something inside their long, tufted tails has to keep them upright. So, through long evolution and adaptation, the compact little "gyroscope" in the ear has developed into its present form.

The other purpose is just as important to the animals on the gravelly wastes of their home ranges. Without some sort of homing instinct, they could not survive long in country where the terrain looks the same for many miles. Whether this homing instinct is connected with the ear bulbs of the kangaroo rats is a moot question, but it does exist somewhere in the animals. Sometimes a kangaroo rat, chased far from its home ground by a fox or coyote, will find its way back to its own burrow through twisted brush, arroyos, and general tough going.

The homes of these desert leapers could be recognized as far as one could see them. They were conspicuous objects amid the cactus and thorny desert plants. Usually these homes are mounds of fine sand thrown up about the base of a greasewood bush or palo verde tree, although sometimes they may almost bury a small prickly pear cactus. Here and there in the mounds, burrow entrances lead down into the tunneled and crumbling castles of the kangaroo rats.

Besides the kangaroo rats, other small animals often made their homes in these mounds. In the course of a night at one of the smaller mounds, our traps frequently caught one or two kangaroo rats, some white-footed mice, a pocket mouse, a lizard, and even a big tarantula spider. Occasionally we found bigger mounds with larger burrow holes, and we knew we would not find such a mixed social gathering in our traps the next morning. These larger mounds were made by the big, banner-tailed kangaroo rats. They are surly, powerful rodents, with ingrown dispositions and a passion for clean burrows. Their mounds held only one or two of the big rats and nothing else.

Once, as we sat by the camp fire in the evening, we heard soft but shrill squeals coming from close by. Bob thought they were made by a bird, and I claimed the noise maker was an insect. By dumb luck, we spotted the real singer. Up on a small ledge, a mouse was sitting on its haunches, quivering with effort as it sent out squeal after squeal. It was a scorpion or grasshopper mouse, one of the most unusually interesting of the smaller desert mammals.

These chunky, short-tailed mice are muscled like wrestlers. They are one of the few species of rodents that have become confirmed meat-eaters. They are great hunters, roaming at night in search of insects, lizards, scorpions, and any other small animals they can master. While trapping mice, I lost many specimens because these little vandals would get to traps first and eat the freshly caught specimens. One naturalist, commenting on the meat diet of these mice, says that the mouse, when ready for its nightly hunt, squats upright on its haunches and gives a shrill squeal. He claims that this is the mouse's attempt at the "hunting roar" of the lions, and other great cats.

Sometimes as we ran the trap line in the early morning, we would see a small desert fox scurrying back from its nighttime hunt. At night, our car headlights would often pick out a motionless, big-eared figure half hidden amid the cholla by the roadside.

At times, a number of the tiny foxes would gather in the rim-rocks of the foothill canyons and make the canyon walls ring with a chorus of excited yaps and slurred howls. The desert would seem like a lonely place to us without these little animals.

Only once did we see the famous collared peccaries or "javelinas" of the desert. They are not rare, but are hard to see. Their pepper-and-salt coloring lets them blend easily with the drab desert tones. That one time we were setting a line of mouse traps out along a small wash. Hearing a swishing sound, we glanced up and saw nine javelinas trot across the wash ahead of us. They were unafraid and perfectly casual, paying us no attention as we stood in plain sight.

Probably no animal tale could be considered complete without some mention of the cat tribe. Everyone is thrilled by the great cats, in different ways. Some admire their superb grace and beautiful fur. Some hate them for the damage they do at times. Some are frankly frightened by their sinister appearance. We all seem to feel a faint quickening of breath when we watch a lion or tiger in the zoo. Perhaps it is a racial memory, lingering in some forgotten corner of the mind, from ancestral days when cats meant terror and stalking death.

Bobcats and mountain lions are still fairly common in many places in the desert country. Every year, professional hunters, with packs of trained hounds, trail and kill many mountain lions in the rough and broken ranges bordering the desert. But the most unusual of the Arizona cats is the jaguar, the great leopard-like cat that strays up from the American tropics.

Ring-tailed cat.

A few jaguars range across the border into southern Arizona, but they are among the rarest animals met with in the entire Southwest. One reason is that, through the years, they have been hunted relentlessly by the stockmen of the border country because sometimes they have been known to kill calves and horses. Rumors of jaguars float around the desert country every year, but it is hard to find an authentic record of one being killed. We did read one local newspaper report of a jaguar killed by a hunter not three miles from one of our campsites. Perhaps this was the great cat that had prowled about our camp one night, leaving his big pug marks.

We heard of one case where the animal in question could easily have been a jaguar. A friend of ours, who has lived on the desert for many years, told us about the occurrence. He had been sitting in his living room reading, one stormy summer night. Suddenly he saw his little Airedale run under the sofa with its tail between its legs. He went back to his reading.

Suddenly a harsh and gutteral "UH! UH! UH!" filled the air. The little dog howled. Ray admits that his hair stood on end for a moment, but he soon recovered and decided to go out and see what it was. He took a flashlight and a heavy rifle and went out. It was a wild, windy night, black as pitch, and he could not see anything. But his light revealed some huge footprints at the corner of his porch. When he examined them, he found they were cat tracks. At the time, he was sure the animal was a mountain lion because there were a few lions in the mountains back of his place. But it could have been a jaguar, because, as far as is known, the mountain lion does not give that deep, gutteral cough.

To most Easterners on their first Arizona trip, the desert seems a dead world, arid and desolate. Gradually they come to know and appreciate the unique desert plants. Then the abundant birds, easily seen and heard, become well-known friends. But the mammals are seldom observed. To all appearances, except for perky tailed antelope chipmunks and lanky jack rabbits, the desert is devoid of warm-blooded, furry animals.

But if the visitor will go out into the desert by night, look, listen and live there, the mammals will become as appealing and familiar as the birds. Or one way to get to know them is to trap a few in small live traps, look them over carefully, and then release them or keep them for a while as pets. Most small mammals are easily caught. They will enter a suitably baited box trap, or other live trap, without fear. It is a good way to meet the desert animals in person.

The best way, I think, is to go out early in the morning, as the morning star pales and before the winds arise. Then the fine, soft sand of every little wash or arroyo will bear the marks of legions of small mammals that fed and played, chased or were chased, under the veil of the velvet desert night.

Faith

By LALIA MITCHELL THORNTON

Oh may I never be
Too old to plant a tree;
Too near Life's outer edge
To stop and set a hedge.

How can I doubtful grow?
One miracle I know,
Proof of the truth of creeds;
For I have planted seeds.

Although not normally on one another's visiting lists, raccoons and skunks feed amicably together at the dishes set out for them at Aunt Sally's night club.

The Woodhouse Night Club

By LUCY FURMAN

In a two-hundred-year-old house on the Massachusetts coast, with the Atlantic Ocean at its front, and thick woods behind it, lives a little woman with a very big heart. She is known to millions of children, who for years have listened to the Bedtime Story Hour of Thornton Burgess, as Aunt Sally.

This is not her real name; she has always refused to have that used. Her surname is a distinguished one, two of her ancestors having been notable men on the *Mayflower*, and another the first Governor of the Massachusetts Bay Colony, known as the Man of Peace because of his just and kind treatment of the Indians. Still another was the first circumnavigator of the globe. Two recent United States Presidents have been related to her, as is Winston Churchill of Britain. On the paternal side her forebears for generations have been sea captains, and rare treasures from their voyages adorn the home in which she now lives alone.

The mother of Aunt Sally, who died still active in mind and body at one hundred, taught her two girls never to turn a hungry or homeless creature from their door, and always there were pets and animal guests of unusual kinds there. One evening, more than thirty years ago, they found a skunk, injured by a car, in their front yard, brought it into the woodhouse adjoining the kitchen, and fed and nursed it back to life. It was a beautiful and affectionate pet, and was never deprived of its freedom, the cat-hole in the woodhouse always being left open at night, so that the skunk might go and come at will. Having absorbed some of the spirit of the home, it soon began bringing other skunks to share the bowls of milk, platters of cookies, and bread-sweetened-with-molasses, left for it every night on the woodhouse floor.

Seeing the new visitors, Aunt Sally prepared for them, spreading newspapers over the floor, and increasing the supply of food. She also put a dim light in the woodhouse, so that she could observe, through a peephole in the kitchen wall, what went on.

At first all the guests were skunks, and happy ones. Then, one night, a new face appeared in the cat-hole—a face with a black mask across it—that of a raccoon. Skunks and 'coons are not on one another's visiting lists, and the skunks grumbled and growled quite a bit at the unwelcome sight. But the first skunk had acquired better manners, and more hospitable spirit, from his hostess. He quieted the others, saw that there were no breaches of etiquette, and the 'coon entered and ate. The next night a whole family of 'coons joined the Woodhouse Night Club.

Seeing their enjoyment, Aunt Sally decided she must become one of the happy company. Bringing

Aunt Sally knows each of her guests by name, and this one is Beauty, a raccoon that has been a regular guest at the Woodhouse Night Club for thirteen consecutive years.

in a low chair, and setting beside it two shallow wooden boxes for stair-steps, she put bowls of milk and plates of food on the steps, and, well wrapped up and with the dim light burning, she sat motionless in the chair awaiting the guests. Nervous, at first, at the sight of her, ready to dart out at her slightest movement, they lost their fear after the first skunk climbed to her lap and began eating from the pan she held. Soon all were eating with their usual zest, not only from the plates on the floor, and from those on the steps beside her, but even from her lap. Before long Aunt Sally began talking to them in low, gentle tones, and they seemed to like this. A beaten path made by small feet was soon to be seen between woods and woodhouse.

Ever since then, Aunt Sally has made a point of sitting with them for hours nightly during the summers and falls. In the summers the Woodhouse Night Club becomes a sort of nursing home, where mothers leave their babies with Aunt Sally while they forage for delicacies of the season—wild fruits and berries, which both skunks and 'coons dearly love, fat grubs of harmful insects such as army worm, white grub, hopworm, tobacco worm, cutworm, beetles, locusts. These the skunks dig every night when the ground is not frozen, and then the 'coons also enjoy them, although their preference is for the crustaceans and mollusks for which, with their little black hands, they literally comb the streams and sands. Then in mid-September, the guests, young and old, come in in large numbers to fatten themselves for their long winter's sleep, which begins around Thanksgiving, when the 'coons retire to tall tree-dens, and the skunks to warm burrows in the ground beneath the snows.

During these fall weeks Aunt Sally frequently buys twenty large loaves of bread a day, cookies and cakes by the bushel and milk by the gallon. At these times, too, she sometimes admits a human friend—one who is willing to don some of her garments and to sit motionless for hours. It was in this way that Thornton Burgess made acquaintance with the Woodhouse Night Club, and in his Bedtime Story Hour began telling children the stories of the guests. For Aunt Sally knows each 'coon or skunk by name, whose children they are, and their varying characteristics. If one is absent for a night or two, she misses it and becomes alarmed.

"No one will ever see the pictures I see when I entertain alone, and so many animals crowd around me, eat from my hands, sit on my lap, and listen eagerly to what I say. Never in the thirty years has any of them misbehaved in any way; no skunk has caused the slightest odor, no 'coon, high strung

Aunt Sally and Crippy, a raccoon guest that lost one leg in the grip of a steel trap.

Aunt Sally and Thornton Burgess, who has told the story of the Woodhouse Night Club and its patrons to millions of young people throughout the country.

though they are, has shown a bad temper. All have gentle manners and loving hearts, are eager to be loved, and lavish with their affection. I am sure they understand what I say to them."

Certainly, Aunt Sally, they understand your tones, if not your words. Love is a language all living creatures know, and respond to. Not only the birds, squirrels and rabbits made their abodes with St. Francis of Assisi, but the hitherto fierce and destructive wolf that became his devoted attendant, valuing love so highly that it was willing to live on the saint's meager diet of porridge and bread-crusts in order to be near him.

"Anyone," Aunt Sally continues, "could do as I do, provided he or she was not nervous." Not just anybody, I fear, for few of us, alas, possess loving hearts.

But Aunt Sally's relationship with her guests is not all happiness; tragedy always underlies it. Time and again a skunk has come in minus a leg or tail, or a 'coon has disappeared, never to return. One night, years ago, a mother coon, followed by five little ones, entered, and was promptly named Crippy. Like the skunks, she had been caught in a steel trap, and had chewed off her own arm to escape the unendurable agony. How she could be the good mother she was, with only one arm to provide food for her babies, and to climb to their tree-den, one could not imagine. But for five years Crippy continued coming, each summer with a new set of children. Then one May, when she was again a nursing mother, she was struck by a car, and her hind quarters were paralyzed. The man in the car had a heart; took her to the Animal Rescue League in the nearest large town. There an ad was put in the papers, and ten days after the accident the news reached Aunt Sally. During these days Crippy had neither eaten nor drunk. When she was claimed by her friend, and found herself again in the woodhouse and in the familiar lap, she at once ate some sponge-cake and drank some milk. But there was no hope of her recovery, and a few days later she died. Her body lies beneath one of Aunt Sally's tall pines. Her babies could not be located, and perished of starvation.

Another handsome 'coon disappeared and was gone three weeks. "Then," says Aunt Sally, "I saw him one evening coming slowly, painfully along the path, hopping, not walking, and (Continued on page 442)

Three of the night clubs skunk guests. Not only do the animals come to feed, but they use the woodhouse as a nursery where they park their young while foraging.

An ombú tree of the Argentine pampas, a plant that seems to hold within it the secret of perpetual life, for no one knows how long it lives; no one has seen one dead or dried.

The Mysterious Ombú

By JOHN W. WHITE

MYSTERIOUS Nature has hidden one of her most inscrutable enigmas in the ombú tree of the Argentine pampas. Does this tree, like certain polyps of the animal kingdom, possess the secret of perpetual existence through constantly dying and renewing life within its own body?

The evidence indicates an affirmative reply. But no one really knows. No one has ever seen an ombú that was decayed or dried with age. No one knows how long they live. Many that witnessed historic events centuries ago are still flourishing. The secret of their age cannot be determined as in other trees. The ombú, although known as the most characteristic tree of the pampas, is not a true tree, botanically speaking, but a gigantic weed that produces ten or more rings a year. It is a living negation of nearly everything we know about trees.

With the exception of the Japanese cherry tree, no plant is so cherished in the traditions of a people as the ombú is in the songs and stories of the Argentines. It has an enormous trunk, and its great spreading branches shade an immense spread of ground. Its weirdly knotted roots protrude from the ground in strange shapes that form convenient resting places for tired horsemen.

Argentine poets have called the ombú the lighthouse of the pampas because, in the days of the gauchos, it often was the only object to be seen for miles and miles on the sea-like plains.

Ombú wood is entirely useless, even as fuel. The tree has no usefulness of any kind except its shade. Yet it is the best loved of all trees in Argentina, probably because of its associations with past centuries.

Many ombús are looked upon as monuments of great historic events in the life of the country—the Ombú of Hope, for example. It is called that because Argentina's George Washington, Gen. José San Martin, sat on its enormous roots with two other eminent men of the day and swore with them a solemn vow to perfect the independence of their country, for which they were fighting. The Ombú of Pedriel was a mute witness of one of the decisive battles against the English invasions in 1806-7.

Several others in various parts of the country are named for the treaties that were signed in their shade during the long period of the civil wars.

One of the oldest known ombús is the Viceroy's Ombú. It is named for Viceroy Vertiz because it stood in his *quinta* at Olivos, a suburb of Buenos Aires, in 1779. The authorities of the Argentine Forestal Society made a careful study of this tree in 1914 and decided that it was at least 500 years old.

Botanists have determined that the ombú is Argentina's only indigenous tree. It seems to have originated in the region of Lake Iberá in the Province of Cordoba. There are a few ombús in Andalusía, Spain, where they are known as *bellasombra,* or beautiful shade, but they were sent there from Argentina in 1775.

Argentina is famous for its fine trees, and Buenos Aires is one of the most beautifully shaded cities in the world. But the trees were imported. When property owners began to grow rich in the latter years of the nineteenth century they brought trees in from Europe by the hundreds of thousands and set them out on their estancias. Beautiful Palermo Park in Buenos Aires was once an estancia belonging to the dictator, Juan Manuel de Rosas, and most of its thousands of trees were imported from Europe.

W. H. Hudson, in *Far Away and Long Ago,* said of the ombú:

"The ombú is a very singular tree indeed, and being the only representative of tree vegetation natural to the soil of those great level plains, and having also many curious superstitions connected with it, it is a romance in itself. It belongs to the rare *Phytolacca* family, and has an immense girth—40 to 50 feet in some cases."

One of the superstitions attached to this strangest of all trees is that a chronic drunkard can be cured for the rest of his days by mixing the sap of the ombú with his favorite poison.

At first glance, the ombú appears to be Nature's abused step-child. Closer investigation, however, suggests that it may be the favorite god-child.

Throughout the vegetable kingdom, plants and trees have been endowed with prodigal fecundity. Incredible cleverness has been exercised in arranging many wily schemes to assure easy and lavish reproduction of nearly all the species. In many plants the male and female reproductive organs are in the same blossom. They cannot avoid generating seeds for new plants. In other cases the flowers are provided with sweet nectar that attracts the honeybee and makes it the unknowing carrier of the fertilizing pollen from the male to the female organ of the flower. In some cases the widespread distribution of certain trees and plants is insured by providing them with seeds that gratify the appetites of birds, so the digested and fertile seeds are dropped far from the spot where they grew.

As a result of all this careful scheming on the part of Nature, the trees we know in North America are are gregarious as Rotarians. There are more than 400 species of trees north of the Rio Grande, and they all have one characteristic in common. If left alone, they grow in great crowds, as in woods and forests. So characteristic is this tree habit that Roget's *Thesaurus* lists twenty-nine words that describe it.

Having gotten the world's trees thus organized so that they would soon spread over most of the earth if men would just leave them alone, Nature seems to have awakened one morning with a wry grin on her face, determined to see how far she could go in the opposite direction. For her experiment, she chose the Argentine pampas and the ombú.

The ombú's reproductive organs are not contained in the same flower. They are not even on the same tree. There are male ombús and female ombús, and Nature is as careful as a dowager Argentine chaperone in keeping them apart. There are other trees with this sex characteristic, of course, the best known being the eucalyptus. But they grow so close together that reproduction is no problem.

Not so the ombú. The reproduction of the ombú by the usual natural process would require that a male tree be growing close to a female one and that just at the right moment a gentle breeze, or an accommodating insect, carry the fertilizing pollen from the flowers on the male tree to the flowers on the female tree. But Nature planned it otherwise. Ombú trees, when left to themselves, do not grow that close to each other. They stand alone in almost arrogant solitude, separated by great distances. Often there is not another ombú in sight.

If by some difficult combination of circumstances the female flowers of the ombú occasionally become fertilized and produce seed, these seeds are so distasteful that birds will not eat them. So there is no way to spread the seed. When an occasional seed that drops at the foot of the mother tree does germinate, the tender shoot is soon killed by the heavy shade. If by some chance a seed falls outside the area of

Countryside in October

By WILLIAM ARNETTE WOODFORD

I took the path where autumn late had gone,
Pursuing summer's spirit down that way.
The gold and crimson maples on display
Glowed like a thousand colors of the dawn.
October now sat weaving at her loom,
The whirr of gauzy wings about her there,
A fox grape sweetness sharp upon the air
Where roadside asters spread their purple bloom.

A fairy lace lay over clustered vine,
And dogwoods flaunted dazzling blood-red fruit
Along the drowsy brook whose languid flute
Was leafy-still where flaming woodbines twine.
Each scarlet bush and purple thistlepod
Proclaimed October the masterpiece of God.

shade and gets sufficient sunshine by day, it succumbs to the frosts that come down on the pampas at night.

Consequently, during the millions of years since the richest deposit of alluvial soil on the globe was laid down to form the Argentine pampas, there never has been a forest of ombús, which indicates some far-sighted planning on the part of Nature. Since the ombú apparently never dies, if it reproduced itself with the facility of other trees, there would be no pampas at all. The ombú forests would present an unconquerable barrier to human occupation of the land, because a forest of ombús could not be removed, even with modern machinery.

Instead of presenting difficulties to the newly arrived farmer in the form of timberlands that must be cleared, the solitary ombú offers him shade and protection from the weather. It also provides a haven for his animals and chickens. It even serves as a shed. When a man settles down near an ombú, he finds it easier to leave his cart and plow and tools under the ombú than to build a shed for them.

Nature played fair with the ombú, however, after making its reproduction almost impossible. She then endowed the ombú with extraordinary means of protection against all those forms of destruction that constantly threaten other trees. One lonely specimen will remain standing through the centuries, where whole forests of other species would have disappeared.

Cyclones cannot blow down an ombú because it is securely buttressed by its mighty roots. These are not like the roots of other trees. They seem to be a subterranean extension of the trunk itself. By means of these huge roots the ombú stores up water for its future needs, as does the camel in the animal kingdom. Consequently, neither drought nor fire can destroy it. The roots and trunk are so filled with moisture that they successfully resist flame itself. The pampas may lie seared and yellow under a prolonged drought; the ombú remains green and fresh, oblivious as always to everything that destroys other trees.

Argentina, too, has its conservation problem. But the ombú is not included in this problem. Since ombú wood is of no use to man, this worst enemy of trees has no reason for cutting this one down, and does not. The repugnant nature of its juices insures the ombú against the usual damage and destruction by animals, birds, and insects.

All this complicated and mysterious mechanism seems to have been set up for the sole purpose of providing shade on the boundless pampas, since that is the ombú's only use. The tree seems specially designed by Nature for a population of cowboys and shepherds, such as lives on the Argentine pampas. It offers them shade and protection from the weather in the heart of the vast open plains on which graze their herds and flocks. The ombú thus solves for man the main problem the pampas provides him.

At night, however, the ombú withdraws its shelter from man and beast. Its leaves become noxious, so no one sleeps under them in the dark. Yet only a few hours earlier this was the favorite spot for the noonday siesta.

After all these strange habits of the ombú have been pondered, there still remains the unsolved enigma. Does the ombú possess the secret of perpetual life? Such a secret would violate all the laws of plants and animals, of life and death. Those laws fix a more or less definite period of life. Sometimes it is longer, sometimes shorter, but at the end there is always death. An examination of the ombú, however, shows that, like some of the polyps, it lives in a constant renewing of its own life. As the ombú dies in the center of its trunk, new life is born outside. It may look like a tree a thousand years old. In reality, it is a young tree that enfolds all its ancestors within itself—a living tomb for all the generations that died before it was born.

Does this process go on without end, as in the seaweed of the Sargasso Sea? That is one of the many questions about the ombú that have not yet been answered. As already pointed out, no one has ever seen a dead ombú. Perhaps a scientific study of the tree's physiology will some day answer this and other questions. In the meantime, on those rare occasions when an ombú is cut down, it always presents the same strange sight. All the inside of the trunk is completely dead. All the original roots are dead. But around that death, enclosing it, is the vital and apparently indestructible life of a new tree, fed and watered by a system of new and vigorous roots.

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Let's Go Nutting

By MABEL IRENE HUGGINS

It is October! It is nutting time again. The following clues will suggest nuts to be found in the woods and at the corner grocery. If you are squirrel-minded, you should gather at least ten from the baker's dozen here listed. Answers on page 444.

1. A South American country
2. A dairy product
3. The seashore
4. A legume
5. A big box
6. One of the palm trees
7. A girl's name
8. A nickname for Margaret
9. Sounds like a sneeze
10. Part of a nonsense line in a Mother Goose rhyme
11. A flowering shrub
12. You hang pictures on it
13. Sometimes on a toe

The Wood Pewee

By JULIAN BURROUGHS

Photographs by the Author

JUST by chance, one day in early July, I discovered the nest of the wood pewee far out on the horizontal limb of an old maple. I was delighted, and resolved at once to get acquainted with the little pewee, to learn her nature and her ways, to bring my mind to her mind, as it were, to reach a full understanding with her. First it seemed wise to see what other bird lovers had felt and expressed about the pewee. So far as I can learn, our New England poet, J. T. Trowbridge, has written the only poem to the pewee; a long and beautiful poem, in the true classical style. Yet, after reading and rereading this poem, I felt it was so much imagery, sentiment and literature, with many quotations from mythology, without much of the actual bird herself. A few lines will give an idea of the poem, as well as how the pewee impressed a poet and Nature lover like Trowbridge:

"When in the hollow shades I heard—
  Was it a spirit or a bird?
Or, strayed from Eden, desolate,
  Some Peri calling to her mate,
Whom nevermore her mate could cheer?
  'Peri, pe-ri! peer.'

"His heart, a spark of heavenly fire,
  Burns with undying, sweet desire;
And so he sings, and so his song,
  Though heard not by the hurrying throng,
Is solace to the pensive ear:
  'Pe-wee, pe, wee, peer!'"

My father, John Burroughs, says of the two-syllable call of the pewee that it is a human sigh. After the July hours and days I spent with the pewee, first ruthlessly divesting myself of any and all preconceived ideas, I came to a wholly different conclusion; almost the opposite. It is neither pensive, nor sad, nor a sigh, but is a voice of Nature herself; strong, serene, assured, fully inevitable, a joyous acceptance,

unquestioning, never doubting. Every one of the hundreds of times I heard that call I felt a glow of peace and satisfaction, as though I had become wholly a part of the spirit that pervades all Nature.

How fearless is the little pewee! Nature writers like to describe the fury with which she attacks a red squirrel, well knowing that the red squirrel robs bird nests. In father's writings I find that he once saw a pewee attacking a gray squirrel in a tree, a statement that made me reflect deeply, because there has always been a question as to whether or not a gray squirrel will rob birds' nests—a question that the pewee at least seems to have answered for us.

When I climbed up to try to get a picture of her and her nest, I instantly learned that squirrels were not the only enemy that this fearless little bird will attack in defense of her young. She evidently regarded me as an enemy, too, attacking me with savage fury. She would hit me on top of the head, time after time; she would project herself at my eyes like a bullet, snapping her beak like castanets—except that castanets have a gentle, friendly sound! In time, however, she became used to me, and, to a slight extent, tolerated my presence—enough to enable me to get some pictures.

The ornithologists all enjoy describing the insect-catching of the pewee—her marvelous eyesight, her flashing speed, her deadly accuracy—"she never seems to miss." It was an unfailing delight to watch her those July days. She would perch on a limb or post, turning her head about in a quick, nervous manner. Then, like a flash, she was on the wing, darting upwards or dropping down, getting her insect, and, with a sweep, getting back on her perch. Watchful, intent, she took her work seriously, as well she might with three young to feed. Some Nature writers say the pewee will go down into the grass for insects, or pick them off branches. Not once did my pewee do this; she took them on the wing with her sweeping, darting flight. Once I saw her high in the air apparently chasing a large insect she could not catch. But there was a smaller one near, which she did snap, and, flying back to her perch, she prepared to feed it to the young. The big one she just did not want.

So the July days sped by, the three young pewees

in the nest growing steadily, getting their feathers for flight. Learning to know her, and feeling her presence, added much to my summer. At times both birds were near the nest, although I never saw both parents come to the nest at the same time. The ways of Nature are wonderful, in which the little pewee is a part—"a part of the scheme of things," as father would express it.

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The Weaver

By EMILY N. HOXIE

When autumn does her needlepoint,
She draws her rose from old Joe Pye,
She takes her tints from mallow pink
Like afterglow of evening sky.
The silver everlasting sheen
She winds about with brilliant thread,
For on great stalks of darkest green,
She takes a stitch of cardinal red.

The borders of her sapphire sea
She does in cat-o'-nine-tail brown,
Sketching their velvet heads close by
Fall dandelions' golden down.
Her sculptured hills she broiders thick
With goldenrod, and purple hue
Of asters, then this tapestry
She fringes with a gentian blue.

★

Birds and a Kickapoo School

By ELSIE H. DEVOL

The class of twenty-one little Kickapoo Indians has developed into a group of enthusiastic bird students.

BIRDS provide the inspiration for many of the studies at our Kickapoo Indian Day School in Horton, Kansas. Oral and written language, reading, spelling, and art are among the subjects that my twenty-one little Indians enjoy seasoning with an amazingly active interest in their avian friends.

Each morning, when the bus discharges my pupils, they rush to tell me of birds seen since the day before. We keep a jot-it-down calendar pad on which are recorded day-to-day observations, often illustrated with an original drawing. Birds to be studied are selected by one or another of the group, and then we explore the subject's value, coloring and other characteristics. It keeps the teacher on her toes always to be just one jump ahead of the more enthusiastic little bird students and bird artists.

The third and fourth grade youngsters proceed at their own pace to compose and illustrate bird stories, while the first and second graders have to be more largely content with oral reports and discussion. All take part in making exhibits, and in keeping the feeding shelves for birds supplied in winter with foods suitable for the different species.

At Christmas time a picture-show-in-a-box presented sixteen winter bird friends of Kansas, and the invitations to the parents were little folders with avian designs made by the little Indians. They composed the words for a little song inviting the birds to a special Christmas tree trimmed with food. Other songs and poems were learned to highlight the showing of the picture show, all of which was constructed by the class.

The bird feeding station was made and is maintained by the children.

The two feeding stations are in view of the classroom windows, and scraps from the midday lunch are added to the food provided. Competition is keen as to who shall be the first to cry, "A bird at the feeding shelf!" Then twenty-one bright-eyed little Kickapoos stand at eager attention at the windows.

Fly Time

By E. LAURENCE PALMER

This is the fifty-first in NATURE MAGAZINE'S *series of educational inserts.*

Illustrated by Heinz Meng

AN EARLIER insert of this series dealt with how time flies. This unit deals with fly time, a season which, fortunately, is gradually changing for most of us, and which in modern times has little resemblance to late summer and fall back in the horse and buggy days. The disappearance of horses from the streets, and of horse stables from our back yards, and the appearance of DDT and other effective sprays, make the canning season in most of our homes healthier, happier, quieter, more peaceful and less strenuous than formerly.

Some of you, no doubt, remember the steaming hot kitchens where canned goods were being "put up". It swarmed with flies from the nearby horse barn. You can still recall a perspiring parent with two flour-sack fly switches attached to the end of broom sticks chasing flies out the kitchen door, slamming the door to prevent the resurgent multitude from again taking over the premises. You can remember lying in bed watching the flies buzz about the ceiling, or being awakened by a fly crawling on your nose. You may even remember being sung to sleep with a little verse about the exceptional ability of a fly to crawl up the wall without falling. True, we still do have flies, and they still make trouble, but on the whole they have been made to take a back seat, at least in our homes and offices. In the woods, on the lakes and streams, and in other places, many of them still reign supreme, but even there their dominance is being threatened by the wholesale control techniques advanced by the economic entomologists. Some day we may even go to a summer resort and have to be introduced to a mosquito, blackfly, no-see-um, or deer fly, but I rather doubt if that time is to be expected in the immediate future. And when it comes we may find that, for some reason or other, the fishing in the hinterland is not so good as it used to be.

But what are these flies about which we have been talking? We have spoken freely of mosquitoes as flies, and were well within our rights in doing so. With equal justice, we could have mentioned midges and gnats as flies. In fact, there are in North America some 10,000 kinds of insects that properly can be considered as flies belonging to the order Diptera. With some minor reservations as to definition, we can assume that the members of this order are characterized in part by having two wings, hence the name diptera. They also have what entomologists speak of as complete metamorphosis: that is, they go through the standard egg, larva, pupa and adult stages in completing their life histories. Their behavior, type of mouth parts, food, economic importance, geographic distribution, seasonal abundance vary so greatly that these characters cannot be considered as definitive for inclusion or exclusion of insects from the order. So far, in this series of inserts, we have already given consideration to some flies. In the first unit, we gave illustrations and life history material on blackflies, midges, house mosquitoes and crane-flies. In the 36th, we added the house fly, the malarial mosquito and the yellow fever mosquito. We now add eighteen more to this list.

HORSE FLY

BEE FLY

FLESH FLY

GREEN-BOTTLE FLY

DEER FLY

SOLDIER FLY

One cannot with safety consider that any insect that has the name fly identified with it is a true fly. Possibly there are as many insects spoken of commonly as flies, but which are not flies, as there are those that the average person recognizes as a true fly. So far in this series we have mentioned dragon flies, stone flies, damsel flies, dobson flies, caddis flies, may flies, and butterflies, all of which are not flies at all. Most of the major groups of insects are represented by some individual that has the term *fly* in its common name. The green fly of the gardener is really an aphid belonging to the group often considered as bugs. The Spanish fly and the firefly are beetles. The saw-flies are wasps, and the butterflies, of course, are to be found in still another group. It is dangerous, then, to jump to conclusions as to what a fly may be, although this danger does not seem to have been recognized by many of the leaders in science education, if we may judge them by their published materials.

Just as it is easy to become enthusiastic fans over butterflies, beetles, or wasps, so one can easily become a fly hobbyist. Ten thousand kinds of organisms in a group give one ample latitude to pick and choose one's field of investigation. As a matter of fact, almost any one of the 10,000 could well be better known with profit to the human race, so here is a wide open opportunity for anyone with the slightest interest in such matters. Ignorance, fantasy, prejudice, fear, superstition and other human emotions will be found to be identified with the study of flies, and some of these

ROBBER FLY

should be modified if we wish to consider ourselves as rational organisms. The rewards will not be only in the realm of satisfying intellectual curiosity. Rather, anyone who can solve certain problems attendant on the control of many kinds of flies might well find himself free from economic worries for some time in the future. Great areas of the earth's surface, now relatively useless to man's economy, might well be made available to satisfy our needs if we could control the activities of the diptera found there. Camping without mosquitoes, blackflies, midges and no-see-ums would be a new experience to most of us. Polio, typhoid, malaria, lockjaw would not be the nightmares they now are could we eliminate flies and their activities from our neighborhood. But even here we would have to be selective, because some flies perform superior services in one way or another.

From the books of Exodus and Leviticus to the tomes of our modern medical societies, flies have been branded as blackguards. Moses declared them unclean, and Rosenau and others have proved it, but still the flies buzzed merrily about their business until we developed our modern insect sprays. And from one end of the country to the other we find communities that ignore what science tells them about flies. I recently visited a Wyoming town that each year has a polio epidemic on the lee-side of a polluted stream that carries away some of its sewage. In spite of this, each year new residents of the community are sacrificed to the inertia of the town. Why we can consider ourselves as "enlightened" people in the face of such examples is beyond me. True, we are better off than people in many other parts of the world, but, unless we really make use of the knowledge we possess, we have little with which we may flatter ourselves. Now we can undertake fly campaigns in whole cities, not just in our own homes or yards. We can practically eliminate the animals over considerable territories. Who knows but the spread of this practice may change the whole economy of the backward parts of the world, and areas that are now dependent on our bounty may find a greater happiness and prosperity through greater freedom from disease and more abundant energy.

The tables accompanying this section give some details regarding the relationships existing between certain flies and our health. Cholera, dysentery, diarrhea, typhoid, tuberculosis, lockjaw, poliomyelitis, and more than a dozen other diseases have been definitely associated with activities of flies. Domestic cattle attacked by flies lose flesh and have lower milk production. If attacked by warble flies, cattle may die, and even their hides may be found to be punctured in their most valuable areas by the fly larvae. Driven frantic by some species, animals may seek escape in flight and suffer violent injury, or may become mired in swamps and be drowned. Horses may be attacked, internally, by the larvae of bot-flies, and, externally, by ear-flies, and may either injure themselves through excessive activity or lose all excess energy and die.

Both men and other animals may find themselves supporting the larvae of flesh flies that may enter wherever the mucous membrane comes to the surface. Some of these may carry infectious diseases, in addition to causing pain and injury through actual destruction of living tissue.

CLUSTER FLY

While we recognize these bad influences of flies, however, we may be inclined to forget some of the good things they do. The beautiful little syrphid or flower flies that hang about our fruits and flowers may perform a distinct service by killing aphids that destroy the plants. Even some of the flies that live in filth in their larval stage may, as adults, perform a useful service in the pollination of fruit trees. One orchard in New York State recently traced the success of its apple crop wholly to some drone flies that emerged from a filth-clogged ditch nearby at the very time the flowers were in bloom. The bees, which would have effected pollination normally, had been destroyed by the use of sprays.

LOUSE FLY

A reasonable examination of the data in the chart material will show the intricate relationships that may exist, as when some fly larvae destroy the parasites of harmful insects, thus rendering a disservice by an involved series of values. One of the dangers of wholesale campaigns against flies lies in the failure of these campaigns to be selective and to protect those creatures whose service to mankind may be obscure but none the less great.

SNIPE FLY

FRUIT FLY

We may summarize some of the relationships between man and flies for the sake of convenience. They affect our food supply divergently. They may help in pollination and they may destroy plant tissues that are valuable. Garden crops, such as radishes, cabbages, lettuce, carrots and onions, are repeatedly destroyed by maggots of flies. Orchard crops similarly suffer injury that affects the salability of the crops and its real food value.

As predators, flies fill contrasting roles. If they prey on us, on our domestic animals, or on other useful animals, they, of course, arouse our ire. Sheep ticks are not popular with shepherds, and sheep ticks are flies. One wonders what would happen, however, if there were no syrphid flies to keep the numbers of plant lice down in our gardens. Predation of the type found with these flies is essential to a balanced existence under normal circumstances. We find different flies that prey on a great variety of animals. Some favor man, while others seek specific domestic mammals. Some seek birds, or specific groups of birds. Others find reptiles or amphibians suitable to meet their needs. A few use fishes as host animals, this, in a way, balancing the

STABLE FLY

DUNG FLY

LONG-LEGGED FLY

BIG-HEADED FLY

BOT FLY

credit sheet set up when a fish makes a generous lunch of flies.

Flies do provide a major source of food supply to many animals. Fish often depend largely on the larvae of aquatic species. Even humans of a primitive type have been known to collect flies and fly larvae and to use them as food. Some of our practices in wildlife husbandry depend on a source of fly larvae to serve as food for young game birds. Much experimentation has been under way to perfect the production of this type of food at a small cost, under inoffensive conditions and on a sustained, planned basis.

Flies have molded history for man again and again. Malaria and yellow fever defeated early attempts to build the Panama Canal. The tsetse flies of Africa have provided barriers more effective than those established by armies of men. Fly-borne epidemics have wrecked elaborate plans of men throughout history, and may have been instrumental in the extinction of many dominant animals in the geologic past. As a group the insects must be reckoned with in any plans we may make for the future. Mastery of them may mean success. Failure to control them may well mean failure. Modern armies recognize this.

As scavengers, flies may serve a role that has been overlooked. It is natural for some flies to seek filth, carrion and waste. The activity of the fly, or of its offspring, may well lead to a rapid reduction of the waste material. This is all to the good, but, unless some provision is made to prevent the spread of the filth, the consequences may be serious. Adult flies bred in filth may carry dangerous organisms for days after they have left their place of origin. This demands a limitation of their activities, or acceptance of the consequences.

Flies have served some obscurely useful functions in many fields. The larvae of some have been used in medicine in the removal of decaying tissue, much as have the larvae of some beetles. The fruit fly, *Drosophila,* accelerated tremendously investigations in the field of genetics by providing an easily cultured animal with significant secondary characters whose life cycle was completed in a short time. Because of this, generations could be studied in a few weeks, as against a few months or years or decades. The principles revealed by these studies were at least suggestive of what might be expected to find expression in other kinds of living things in the plant kingdom or in the animal kingdom.

Flies also react significantly to such physical phenomena as heat, light, sound, humidity and so on. Studies made of these tropisms, as found in flies, may be significant in understanding some other animals. We may expect further worthwhile investigations in this field. Eventually, we may be able to develop specific repellents that may bar dangerous and irritating species when such protection is necessary for comfort or efficient activities of man or of animals. The past decade has seen phenomenal progress in this field of investigation. What the next may yield will probably be even more important.

SYRPHID FLY

MARCH FLY

While the chemists have been exploring the likes and dislikes of flies, and the effect of various substances on the activities of these insects, the physicists, too, have had their problems. The mere mechanics whereby a large-bodied insect was able to fly at superspeeds with relatively small wings provided a real challenge to understanding. Ultra-speed photography has helped increase our understanding here. When one observer contended that one of the horse-fly group flew faster than any other living organism was able to move on the earth, others contended that a fragile organism such as the fly could not withstand the speeds involved. What the truth may be we do not here presume to suggest.

Meteorologists have pointed out that the behavior of some flies may indicate probable changes in the weather. Most of us have experienced particularly vicious attacks of some of the biting flies just prior to a storm, and we who have been in the woods much have recognized that while some flies bite actively in the sunlight others seem unable or unlikely to attack us except in the shade. Light and temperature condition considerably the behavior of many flies, without doubt. What the nice adjustments may be here we do not know. Neither do we know what fragrances attract or repel many of the flies that seemingly appear from nowhere when an animal dies or dung may be freshly deposited.

Flies have contributed to man's understanding of Nature in many ways. The old doctrine of spontaneous generation received a serious set-back some two hundred years ago when Redi demonstrated that meat could not produce flies spontaneously unless the flies could lay eggs on the meat. Since that time many observers and writers have chronicled the activities of flies. Fabre did this with a mastery equalled by few. Others may have made more intensive studies of fewer organisms, but few have provided the happy combination offered by this naturalist.

A distant relative whose house was always overrun with flies used to accept them philosophically. As long as she was satisfied that they came from her own barnyard, and were "her flies," rather than the filthy beasts that might have bred in a neighbor's yard, she did not let them worry

(*Continued on page* 424)

COMMON NAME SCIENTIFIC NAME	MARCH FLIES *Bibio sp.*	SOLDIER FLIES *Stratiomyia sp.*	HORSE FLY *Tabanus stratus*	DEER FLY *Chrysops vittatus*
DESCRIPTION	Gnat-like flies that may be either red, black or yellow, with relatively small but distinct heads, with the antennae usually shorter than the head. Legs, relatively short and stout. One species, *B albipennis,* is white-winged and relatively long-legged.	In most soldier flies the abdomen is broad and flattened, the wings at rest lying parallel and close or overlapping. Antennae are thick and of few segments. In many kinds, there are conspicuous yellow, black and green stripes across the abdomen. There is much variation, however.	Female, to 1 inch long, black, with blue-white bloom on the back. Wings, smoky. Eyes, separated. Outer wing margins not parallel. Male similar to female in general, but eyes touch each other and are proportionately much larger. Fast fliers and villainous biters of warm-blooded animals.	Length, to about ⅜-inch. General outline, triangular. Wings, with smoky bands and generally rather beautiful flies in every way except their behavior. Marvelous fliers. Eyes of the males touch each other, while those of the females are slightly separated. At rest, wing-spread is about ½-inch.
RANGE AND RELATIONSHIP	Family Bibionidae. The name March fly is misleading, as few appear by that date, and many not until autumn. The adults may appear about the flowers of the commoner fruit trees, although some on occasion enter houses and are found on windows with other flies.	Family Stratiomyidae. A large family well represented in North America with at least forty genera and over three hundred species. While most of the flies are found as adults near water or wet places, this is not true of all. Similarly the larvae are found in a variety of places.	Family Tabanidae. Relatives include gad flies, deer flies, and so on. Commonly found in woods, or in open about swimmers, or around cattle and horses. Not gregarious as are some flies. Some 200 closely related species are to be found in various parts of North America, usually in the warmer parts of the year.	Family Tabanidae. At least 63 species of deer flies, or ear flies as they may be called, are to be found in North America. Closely related to the horse flies and to the green-headed monsters, gad flies and breeze flies. Commonly found buzzing around the heads and ears of horses and of men.
REPRODUCTION	Larvae of March flies may live on decaying plant material, or feed on the roots of growing grasses, or even live in excrement of different kinds. The larvae have ten pairs of spiracles or breathing pores, which is a rather large number for the related flies.	*Stratiomyia* larvae are aquatic, slender grubs with a circlet of hairs at one end, which opens at water surface when air is taken in. Pupal stage is within last larval skin and is commonly found away from the water. Larvae of many species are predacious.	Eggs laid on marsh plants hatch in 1 to 2 weeks when exposed to sun. Larvae, greenish-white "worms," which in some species may be to 2 inches long, live in water or in moist soil. Usually winter in soil, and in spring form yellow-brown pupae to 1½ inches long. Adults emerge with the advent of warm weather.	Glistening black eggs are laid on water plants just above the water line, or on exposed stones at water's edge to form conspicuous patches. Larvae, worm-like, aquatic, drop into water to become ½-inch long before forming pupa that is not enclosed in the final larval skin.
HABITS	One species is known to carry the cause of fire-blight, a relatively common disease of pears and apples, although some question this relationship. The insects are often found in large numbers, forming flocks over fields and meadows during the warmer parts of the year.	Representative habitats for some genera of soldier flies are in decaying wood, *Pachygaster;* toilets, *Hermetia;* cow manure, *Myiochrysa;* under stones, *Geosargus;* in water, *Stratiomyia* and *Odontomyia.* Some are found in wasp nests and others commonly in mouse nests.	Food of larva and adult, other animals, the adult female feeding on the blood of warm-blooded animals. Bite is painful and is effected by cutting and piercing stylets that can cut through toughest hide. Known to carry *Bacillus anthracis* which may cause anthrax or lockjaw, and the trypanosome that causes surra.	Only the females bite, the males feeding on plant juices. Larvae feed on small aquatic animals; adult females on blood of men, horses, deer and other animals. Known to transmit blood parasite *Filaria diurna,* cause of filariasis, and *Bacterium tularense,* the cause of tularemia, both serious diseases of men.
ECONOMIC IMPORTANCE	Apparently of no outstanding economic importance, although the economic significance may not be fully appreciated. The association with flowers of fruit trees may be good, or, in the case of carrying disease, it may be bad.	Larvae may be scavengers in water or elsewhere. Others may be useful as predators. There does not seem to be any spectacular association of these flies with human health or comfort, although the larvae of some species may infest fruits, potatoes, and vegetables of a number of kinds.	May be more important in disease spread than is usually recognized. While they may be beautiful, they are never desirable companions. Their bite should not be permitted wherever it can be avoided. Fortunately they are abundant only in definite areas, and at more or less specific times of year and day.	Control is by draining of possible breeding places. Abundance may affect value of various areas for residential purposes. Ordinarily there is little danger in their bite, but serious consequences are possible, and the animals are rarely welcome anywhere. They may drive domestic animals almost mad, causing runaways.

SNIPE FLIES *Rhagio mystaceus*	BEE-FLIES *Bombylius sp.*	FRUIT FLY *Drosophila ampelophila*	ROBBER FLY *Asilus notatus*	LONG-LEGGED FLIES *Dolichopus sp.*
Medium-sized, slender flies with rather long legs, with abdomen tapering to the rear, and a rather onward-directed proboscis in front. In some species, there are patches of short, dense, contrastingly colored hairs, while in others the body is naked. Hairs, if present, are not long bristles.	Relatively small bee-like flies with narrow, widely spread wings, relatively large abdomens, small heads and abnormally long, straight probosces. The general appearance in the field is of a fuzzy fly that hovers and then darts suddenly in any direction. Color is usually dark or with dark wing marks like horse-flies.	Length, under 1/4-inch. Wing-span, to 3/8-inch. Male, slightly smaller than female and with hind part of abdomen more strongly colored. Male also has sex combs on the front legs, although the function of these is not obvious nor easily demonstrated.	Length of some species, to 2 inches. Others to 1/5-inch long. Wings usually, although not always, held at right angles to body. Eyes, conspicuously large. Legs, long and large. Abdomen, slender. Some species may resemble bumblebees, but are stouter and hairier. Thorax, considerably enlarged.	Under 1/3-inch long, bright metallic-green or blue abdomens. The males of some species with areas on the front legs that can be displayed in courtship. Other species have display organs on other parts of the bodies of the males. Legs, long. Antennae, short. Heads, small.
Family Rhagionidae. By some considered as the Family Leptidae. Seven species are listed from the genus in New York, and a half-dozen genera from the family in the same state. The flies are usually not very active, and may be found in abundance in low vegetation at times.	Family Bombylidae. A large family common in North America, where there are over forty genera and over 450 species. The hovering habit is a reasonably suggestive identification, and the animals commonly favor sun. They are not commonly found on leaves, usually favoring some other type of perch.	Family Drosophilidae. These flies are to be found in many species in many parts of the world. Commonly found about ripe and decaying fruit or plant tissues, or around spoiling fruit juices. Flies are frequently spoken of as sour flies, vinegar flies and pomace flies.	Family Asilidae. One of the largest families of flies, with over 500 kinds found in North America. Individuals are solitary and are commonly found perched on exposed stump or twig ready to pounce on passing prey, or to eat insects that have already been captured.	Family Dolichopodidae. A large family of flies with representatives to be found throughout the United States and most of Canada. Different genera favor different habitats, varying from water surface to the bark of old trees, as suggested below.
Larvae of snipe flies live in a variety of situations, some being found in water, some in burrows of wood-boring insects, some in moss or grass or other non-woody plants. Some contend that larvae feed on the bodies of their dead mothers in some related species and genera.	Larvae of the bee-flies are commonly found associated with other insects, some feeding on grasshoppers from eggs to adults, others on beetles, bees, caterpillars, wasps, some being even parasites of other insect parasites. They are practically all dependent in the larval stage on other insects.	At living-room temperature, eggs laid on fruits such as grapes or bananas, or on vinegar and beer, hatch in 2 days. Diminutive maggot larvae mature in 3 to 4 days and develop into pupae that are small, oval and, in fruit, last 4 to 5 days. Under ideal conditions a complete life cycle can be completed in 8 days.	Eggs usually laid on or under ground, or in damp wood, hatch into legless, worm-like larvae that feed on other insects found in rotting wood or in loose soil, under or in rotting leaves, or under rotting bark. Pupal stage spent in the ground most commonly without any special covering.	Males of many species show definite courtship display of special parts. Larvae of some species are predacious, while those of others may feed on decayed vegetation. Little is known of the life histories of American long-legged flies as contrasted with the European species.
In the related genus *Atherix,* the adults may crowd together and die in great numbers within a small area. Sometimes many bushels of the flies may be collected, and Indians have been known to prepare them for food. This does not, however, apply to the species or genus here figured.	Adults commonly feed on flower products such as pollen and nectar, which they may collect while remaining poised in the air before the food source. Except where the hosts are useful insects, the bee-flies can be considered as useful. Certainly they fill an interesting niche in the biological balance.	Food suggested above. Essential role is that of scavenger. Strongly sensitive to light, going towards it from darkened chamber. Known to carry *Aspergillus niger,* cause of smut disease of figs, and *Erwinia amylovora,* cause of fire blight of apples and pears. Reproductive powers are obviously enormous.	Food of larvae and of adults, other insects. Adults may be seen flying with huge insects held firmly, or may be watched while the meal is being finished. Are relatively unsuspicious and always interesting to watch. Never attack man or his domestic animals, although they may light on them rather frequently.	Sea-beaches often swarm with *Thinophilus,* while wet earth at water's edge has *Hydrophorus,* the water surface at edge of falls *Hercostomus,* the bark of tree *Medeterus* and *Neurigona,* old logs *Tachytrechus. Melanderia* is represented on the Pacific Coast.
There seems to be no record of serious damage caused by these flies to man, or to his crops or domestic animals. The adult of one genus in the family feeds on blood much as do horseflies. On the whole, these flies are probably essentially useful in terms of man's interests.	Bee-flies offer a challenge to entomologists and to agriculturalists charged with determining their economic importance. On the whole, they may probably be considered as useful organisms. No one can question that the animals are interesting to watch or to study.	Major use to man is in the study of heredity. Insects have superficial characters and variations that are transmitted to succeeding generations and make the study of many generations possible in a relatively short time. Also of some value as scavengers, as suggested above.	Economic importance depends on the insect prey selected. They have been known to capture honey bees, which are, of course, useful, but apparently they do not specialize on their prey as do many other animals. They are among the most interesting of insects to watch just for the fun of it.	These flies have probably been seen by every outdoor person in America and recognized by few, and yet few of them are well known even by the highly trained average entomologist. Since most of the adults probably prey on other small flies, they are probably relatively useful.

COMMON NAME SCIENTIFIC NAME	BIG-EYED FLIES *Dorilas atlanticus*	SYRPHID FLIES *Syrphus sp.*	FLESH-FLIES *Sarcophaga haemorrhoidalis*	CLUSTER FLY *Pollenia rudis*
DESCRIPTION	Exclusive of wings, the length is about 1/8-inch in most of these flies. Heads are conspicuously large and composed, apparently, almost wholly of eyes except for short antennae. Head is almost spherical and is wider than the thorax. Body is naked and sparsely haired. Wings at rest, parallel.	Small, prettily colored flies, with yellow-banded or black abdomens, some resembling honey bees rather closely, while others are more like wasps, being bare and flying awkwardly as do many wasps. Most are excellent fliers, a few buzzing or droning when in full flight.	Length, about 5/8-inch. Pale grayish-brown in general, with longitudinal darker stripes on the thorax and a checkerboard of dark spots on the sparsely hairy abdomen. Head relatively small, but eyes conspicuous and antennae inconspicuous. Wings at rest neither widely spread nor folded.	Slightly larger than a house fly but more sluggish, moving slowly and with wings held more closely together. Thorax, dark woolly with hairs. Abdomen, brown, with whitish spots. Space between the eyes white. When mashed makes a greasy spot and has a disagreeable odor.
RANGE AND RELATIONSHIP	Family Pipunculidae. A small family of some thirty species in North America, of which the largest is the type genus *Pipunculus*. Wings in all of the members of the family are longer than the abdomen. Flies are commonly found in shade, usually associated with flowers.	Family Syrphidae. In the family there are some 300 kinds of syrphid flies ranging through North America north of Mexico. Included in the relatives are the drone flies. Adults are usually found about fruits and flowers, particularly those on which aphids are to be found in abundance.	Family Sarcophagidae. A large, widely distributed family of flies of no small economic importance. Not so common in houses as are house flies but found there. The eggs and larvae are found in flesh, on dung, carrion, cheese, oleomargarine, pickled fish, waste, fresh fish, dead and living insects.	Family Calliphoridae. This is the blow-fly family. This species apparently introduced from Europe at an early, unknown date. Found commonly on sunny windows in fall and spring, or on the sunny sides of buildings in spring, or sometimes on snow or on the earth outside buildings.
REPRODUCTION	Larval stage of most members of the family live as parasites on bugs, but apparently the life histories of the group are not well known, as a rule. There is little evidence to indicate that the animals are scavengers in the sense that house flies may be.	Eggs of some species are laid among plant lice. When the eggs hatch, the larvae attack the plant lice, one having been observed to destroy 25 in as many minutes. Larvae are slug-like, to about 1/2-inch long, often with white stripes, commonly greenish, eyeless, flat, transversely wrinkled, and pointed in front.	These flies apparently deposit living larvae on the substance on which the larvae will live. As many as 20,000 eggs have been found in a single female, indicating the potentialities of reproduction. Pupation takes place after the larva has left its source of food supply.	Mate about February. Eggs laid on garden soil a month later, one laying as many as 97 an evening, hatch in 4 to 6 days into white, legless maggots that enter earthworms during mating and live as internal parasites about 3 weeks. Pupates in soil 2 to 6 weeks and winters as adult. Abundant when seeking hibernation.
HABITS	Adults may be found hovering about flowers in the shade, and may be seeking food or potential hosts for the succeeding generation. In spite of their small size, they are rather well known by observant naturalists because of the disproportionate size of the heads and because of the hovering habit.	Food of adults usually pollen. Five types of larvae based on food habits. Flat, green type feeds on plant lice; cylindrical type bores into plant bulbs; those with long tubes may feed in filth; those with short tubes may also feed in filth, and a short hemispherical type feed on insects in ants' nests.	Food of larvae and adults usually is filth. Among places in which larvae are placed in addition to those suggested are stomachs of frog, skin of turtles, vaginae of women who have been sun-bathing, wounds, stomachs of humans, under human eyelids, in living snails, in rotting vegetable material.	Food of larvae, earthworms; of 107 worms examined 74 supported 87 cluster fly maggots. Above temperature of 50° F. adults go towards light and avoid contact; below 50° F. avoid light and push against contact. In fall, then, they seek dark windows from outside only to reverse field and try to get out from warmer indoors.
ECONOMIC IMPORTANCE	Probably of little economic importance, at least in an obvious way. Since the larvae live as parasites of other insects, it may be assumed that some of them at least are useful as destroyers of harmful species, particularly when the favored group usually has a bad reputation so far as man's economy is concerned.	None of the group stings man. Larvae taken from foul water accidentally drunk by man may cause trouble and myasis. Most adults and larvae are useful destroyers of insects that are harmful to man's interests. Some larvae may burrow underground to feed on plant lice living on plant root systems.	Primarily scavengers suited to eliminating decaying organic material, but adults distribute filth and have been known to cause intestinal and skin myasis in man, to aggravate wounds and tumors. It is probable that the female is attracted by odor to a place suitable for the developing larvae.	May be annoying to housekeepers; may be considered as enemies of useful earthworms and as food for many insect eaters. Their close relatives the blue-bottle flies and screw-worm flies, of course, have dangerous habits so far as man's interests are concerned, but this species apparently does not harm man directly.

GREEN-BOTTLE FLY *Lucilia caesar*	STABLE FLY *Stomoxys calcitrans*	HORSE BOTFLY *Gastrophilus intestinalis*	DUNG FLIES *Scatophaga sp.*	LOUSE-FLIES *Lynchia americanus*
Like a small, greenish blow-fly with relatively large reddish-brown eyes that seem to monopolize the space of the head. Antennae, short. Wings, clear and held partly spread to the extent that they do not cover the abdomen to any considerable extent. Abdomen and thorax, distinctly metallic in appearance.	Length, from ¼- to ½-inch. Gray, with darker mottlings. Eyes, reddish, with those of the male separated by a distance equal to ½ the head diameter, while those of the female are separated by 1/3 that measurement. Wings, clear. Mouth suited for piercing rather than for lapping.	Length, about ¾-inch. Resembles a honey bee, but female has long abdomen bent forward beneath the main part of the body. Wings, dark-spotted, with those in the center forming an irregular cross-band; otherwise the wings are transparent. Wings seem relatively small for such a large-bodied fly.	*S. stercoraria* is approximately ½-inch long. The flies are usually rather slender, long-legged, commonly with yellowish hairs, with relatively small heads and small eyes and with abdomen appearing to be banded. The body is usually held rather high by the longish legs.	Yellowish - winged fly with the body flattened from above, the head small and closely attached. Antennae, relatively short. Eyes, conspicuous but not too large or joined. Wings, about twice as long as from tip of head to tip of abdomen. Legs, neither conspicuously large nor small.
Family Calliphoridae. A relatively large, widely distributed family that includes the blow-flies of the type genus *Calliphora,* cluster flies or buckwheat flies of the genus *Pollenia,* the screw-worm fly of the genus *Chrysomyia,* the large blue-bottle fly of the genus *Cynomyia,* and some parasitic flies.	Family Muscidae. This is the same family as that to which the house fly belongs. This species is common outdoors in warm weather, or indoors in muggy weather, and is recognized as the biting housefly. It is reported that these flies have brown wings when found near woodlands.	Family Gastrophilidae. Some authors consider the family name as Oestridae. It includes the gad flies, botflies, breeze flies and similar flies, in most of which the lower part of the head is relatively large, the eyes relatively small, and the mouth opening small. World-wide in distribution.	Family is called Scatophagidae by some and by others considered a part of the Calyptratae. Six species are found in a state like New York, and *S. stercoraria* (figured) is both common and widely distributed. The different species in the group have widely varying habits.	Family Hippoboscidae. The family includes a number of wingless flies such as the sheep tick, *Melophagus ovinus.* Some species retain their wings, others lose them, and still others never have any at any time. All of the members of the family are parasitic.
Larvae are to be found on carrion or in manure or even in garbage. The life history is probably completed in from three to four weeks, of which about half the time is spent in the larval stage. Of course, the life histories of the related species and genera depend on the food of the larva.	Eggs, about 1/25-inch long, placed on any moist substance, have distinct lateral furrow; hatch in 1 to 3 days. Larvae like those of house fly but found on variety of decaying substances, even decaying lawn grass; mature in 1 to 3 weeks. Life cycle may be completed in from 19 days to 3 months or more.	Yellowish eggs to 500 or more are laid singly usually on fore-knees of horses. These are licked off, hatch when moist, and larvae make way to stomach of horse where it develops for 10 months, molting twice and sapping vitality of horse. When mature, passes out in manure and pupates in ground 30 to 45 days.	Eggs are laid in cow dung, where the larvae develop much as do the larvae of house flies in horse manure. Eggs are laid when the dung is fresh and development begins early. Larvae of some dung flies in plant stems, while others develop as parasites of caterpillars.	In the related sheep tick, the larva becomes full grown within the adult female and is deposited on the host animal. Development from such deposition to adulthood takes approximately three weeks. It is probable that development of the young of this species is somewhat similar.
This species is known to carry the bacillus that causes lockjaw. An individual larva that had fed on infected meat has been known to develop into an adult that remained infected and a potential danger to human health for more than two weeks after the adult fly had emerged from the pupal stage.	Food of larvae is decaying organic material, but decaying straw in manure is favored. Winters probably in larval or pupal stage. It has the peculiar habit of biting most viciously before the beginning of storms. It is known to carry bacteria, protozoans and other organisms that may affect living things.	Food is obtained from the host horse by the larvae taking it anywhere from the intestines to the rectum, causing severe irritation and possibly serious illness. Other closely related species behave similarly in their host animals, the deer, squirrels, rabbits and other species.	Adult dung flies are commonly predaceous and may feed on insects as large as honey bees. The flies are relatively active creatures, as they must be to obtain food. A common trout fly is modelled to some semblance of this group of insects.	A number of species of *Lynchia* are hosts to the protozoan *Haemoproteus,* with different species being found in different hosts. This same genus of protozoan is found in some reptiles, some in mosquitoes and so on, but the transmitting organism may not be a louse fly.
Obviously this fly is a potential threat to the health of human beings and an enemy to our interests. It can be kept in reasonable control by screening potential breeding spots. Related species may be serious pests to live stock, among these being the screw-worm fly.	In 1912, Rosenau and Brues claimed to have transmitted poliomyelitis virus to monkeys by this fly. Control is by screening, by destruction of potential breeding places, by use of quick-lime on wastes, and by use of the newer insect sprays that destroy the free-flying adults.	Control is essentially spraying regions where eggs may be laid, chiefly on forelegs of horses, with a mixture offensive to the flies. This mixture may be offensive pine-tar and lard. Medicines are available that loosen the larvae and free them into the intestinal tract where they may pass out of the body.	Larvae are essentially of the scavenger type, while the adults, of course, may be considered as destroyers of other insects, some of which are useful, while others, of course, are not. Apparently they have no record as carriers of disease in spite of their association with dung.	*L. americanus* is commonly found on owls and hawks or on ruffed grouse. Related genera are parasitic on deer and other kinds of game mammals and birds. Some forms are winged until they find a host, and then the wings are shed.

(Continued from page 419)

her. Some of us cannot be so charitable of the situation. In the early days at Cornell, the new veterinary college had its barns some distance from the home of a professor of civil engineering. In a faculty meeting, the engineer complained that the veterinary college was a public nuisance, and offered as evidence the fact that he had marked some flies at his home and taken them to the veterinary college, only to find them later at his home. In answering the indictment, the professor of veterinary medicine commented in a strong brogue that, while he appreciated the careful studies in entomology made by the professor of civil engineering, he could not help but feel that if the flies deserted the veterinary college for the more inviting home of the professor of civil engineering "there must be a r--rr-reason." Tradition has it that the matter was dropped then and there. And so it is if we have flies, or if we do not have them, our knowledge of their control is such now that we can find a reason for their abundance in almost any place.

There is every reason to believe that flies appeared first on the earth in late Permian times, at about the same time as did the beetles. The grasshoppers, bugs and dragon flies had appeared earlier in the same period of time, with the cockroaches still earlier, and the wasps, caddis flies and some other groups in the Jurassic, much later. Still later in the Tertiary came the moths and butterflies, so our flies appeared about midway between the time the first insects appeared and the more highly evolved forms came into being. This of course was long before man put in his claim to mastery over the surface of the earth. If we must be philosophical rather than conceited, we must wonder if, after all is said and done, there is not considerable probability that when the last man has wiped out the last fellow man with an atomic bomb, or some other heinous product of his brain, somewhere, in some hidden crevice, there may not still be some flies ready to come out and again put in their claim for supremacy.

From what we have found so far in this insert, it is obvious that even if flies do eventually take over for us, it is quite evident that even then they will find themselves engaged in activities directed towards the destruction of foods that might help other flies survive, or towards the destruction of other flies themselves. One must doubt if removal of man from the pinnacle, and the substitution of flies, would tend to make the earth the home of one big happy family of organisms dedicated to mutual help. It does not seem to be in the cards for man to "live happily ever after," any more than it seems likely that flies as masters could establish a millennium. As Jane Ace used to say, "We must learn to take the bitter with the better and make the most of whatever situation presents itself." At least so far as our conflict with flies are concerned we should go down fighting. There is reason to believe that, in the geological past, flies have been an important factor in the elimination and extinction of some of the larger inhabitants of the earth. There is equal reason to believe that they will not find it so easy to wipe us out of competition. Certainly if we could learn to be selective in our control measures, and enlist the services of useful species in controlling those whose activities are competitive with ours, our task will be greatly simplified. We can well afford to direct some of our most intelligent efforts to this end. We cannot afford to let the flies win the battle through default on our part. We must aim to make the most of what we know, and not let valuable discoveries go unused, as was the case with DDT. We must not expect as yet perfectly selective control measures and must therefore demand that public servants in positions of power follow the most intelligent leadership available in undertaking control measures that may have wide influence. We must never forget that man prides himself on differing from other animals in possessing reason, and that the mere possession of that power cannot be accepted as an excuse for failure to use it.

Aesop is reported to have attributed to a fly the ability to philosophize like a human when he said, "The fly sat upon the axle tree of the chariot wheel and said 'What a dust do I raise!' " Another writer drew a dangerous simile when he said,

> "A convert's but a fly that turns about
> After his head's cut off, to find it out."

All of us have heard the sayings that "flies are easier caught with honey than with vinegar", that "even the lion must defend itself against the flies", and "to a boiling pot flies fly not". We remember the fairy tale about the meek little man who killed a large number of flies at one blow, and, on his reputation for killing large numbers, went forth to fight dragons and win fame and wealth for himself. As our understanding of the real role of these insects increases, we will find new uses for their activities, and new ways to defend ourselves against the damage they may cause. It takes only eight days to watch a fruit fly complete its life cycle, and only a few more to observe the story of other kinds of flies. It would seem that it would be worth our while to have everyone, at some time in his younger days, get a better understanding of the life history of some fly than we now have. With this understanding we can set the stage so that flies of different kinds must do what we want them to do, whether it leads to their extermination or not. We should give up chasing flies with fly swatters and, with suitable knowledge of their habits, regulate their activities accordingly.

We all know of the legend of the spider and the fly. With proper information we can, like the spider, invite flies to their doom with considerable success. Beelzebub was the god of the Philistines supposed to ward off flies. Zeus Apomyios was the Greeks' fly god. Similarly the Cyreneads worshipped the god Achor. I rather think that modern man is likely to put more faith in DDT.

Still Gambling with Waterfowl

On the heels of its statement that "waterfowl production has shown some improvement this spring but, compared to the favorable years of the past, the breeding grounds are still seriously underpopulated," the Fish and Wildlife Service proposed, and had approved, an open season on migratory waterfowl for 1948-49. This season is a further experiment in flyway control, with gunners in the Pacific and Central flyway states being given a slight break over those in the Mississippi and Atlantic flyway states. This has provoked controversy among duck hunters, East and West, and we are disposed to let them argue the matter among themselves.

Our concern is the future of the migratory waterfowl population as a part of our avifauna. We believe that the birds should serve as targets for gunners only if the population is safely large. We do not believe that the data on their condition assembled during the period of the northern flight and on the breeding grounds indicate any significant improvement over the conditions of 1947, which were officially described as dangerous.

Last year's regulations represented a cut in bag limit and length of season, but did not, we feel, face the issue squarely and give the birds a chance to come back through the only logical regulation—a closed season. Since there has been slight improvement, we still think a closed season affords the only safe guarantee of quick and substantial restoration. Such a season, of course, would mean loss of state and federal revenues from the sale of licenses and duck stamps, loss of some income from the arms and ammunition tax, and economic loss to those who make a living from shooting activities. It would also make a small army of gunners sore.

So an open season has been declared. It starts one half-hour before sunrise, which we regard as bad. It offers the states a choice of a 30-day continuous season or two split seasons of 12 days, on the two eastern flyways, and longer, continuous or split seasons on the western flyways. Also, we must again point out, the season starts on October 8 in the North and ends on January 8 in the South, so the birds still have to run a three-month gauntlet if they try to make it all the way from northern breeding grounds to southern wintering waters.

There are no few among the duck hunters who believe that an open season is unwise. They feel that the meager bag and short season make hunting hardly worth the effort. They would like to see many more ducks. So would we, although for a different reason. But, short of the sort of biological miracle that does not happen, this can never be accomplished by continued hunting pressure. The official guardians of this wildlife resource are still gambling.

Give the Mourning Dove a Break

Cooperative study in eleven southern states to establish facts upon which to base mourning dove shooting seasons is under way. It is about time. Not that we can see any excuse, anywhere, for classing this agriculturally valuable, four and one-half ounce bird as "game," but, if target-hungry gunners are going to be allowed to continue to shoot this beautiful and valuable dove, regulations should be based on something more than political pressure and desire to sell hunting licenses.

The mourning dove is a migratory bird and therefore under the jurisdiction of the Fish and Wildlife Service, and subject to the migratory bird hunting regulations. Mourning doves are now shot legally during the season in 26 states; the rest provide complete protection. Canada and all of the northern states except Illinois, Idaho and Oregon protect this bird. Illinois still permits a reprehensible open season starting September 1, a date upon which some twenty percent of the dove nests contain young doomed to starvation when their parents are shot. Maryland, Kentucky, Missouri, Colorado, Kansas, New Mexico, Oklahoma, Arizona, California, Idaho, Nevada and Oregon also have a September first opening date for the dove season, all undoubtedly cruelly dooming to death some fledglings.

Minnesota, through the indefatigable leadership of Guy Atherton and the St. Paul Bird Club, was the latest state to join the protectionist ranks. Nebraska, after a long closed season, fell off the band wagon in 1947 but climbed back on in 1948, when even a poll of gunners showed 74 percent for continued protection.

Dr. K. Elliott McClure, biologist, declares: "There should be no hunting of doves north of the 37th parallel. Probably the division line should be along the southern border of Virginia, Kentucky, Missouri, Kansas, Colorado, and across Nevada and central California. All of the area north of this boundary should remain as a vast breeding range to maintain the species and to provide a shootable surplus."

Yet today the mourning dove is still being shot where it should not be shot, and is a favorite target farther south, where too little is known about its habits. It is a frequent target for boys, who kill many immature doves whose minute amount of edible flesh is too little to bother with, and the birds are left to rot.

We need some real conservation leadership in those states where the dove should be given complete protection, starting with Illinois, which is a wildlife conservation desert anyway. And, if we are not to send the mourning dove down the tragic path of its cousin, the passenger pigeon, we must have some courageous conservation leadership, federal and state, to manage the bird intelligently in the South.

Autumn Poetry

By FELICE DE HORVATH

Autumn poetry should be
Crisp and crackling revelry.

Gusts of wind and leaves that scurry,
Rabbits in a fearful hurry;

Tang of woodsmoke, goldenrod,
Earthy smell of sun-baked sod;

Mourning dove and cawing crows,
Birds in flight—where?—no one knows.

Hoar-frost icing on the vale,
(Autumn telling winter's tale);

Yellow pumpkins in a row,
Touched by first light flakes of snow—

All of this, it seems to me,
Autumn poetry should be.

★

The Fall of A Tree

By RALPH M. SARGENT

THE warm southern sun of a June morning filtered down in green reflections through the cool forest. For several hours we had been climbing one of the richly wooded mountains of the Great Smokies. More than five miles back, on the other side of the mountain, lay the last road of civilization, an unused wagon trail; ahead, on this side, the primeval forest grew undisturbed for twenty miles and more.

We had been pleasantly observing plants and rocks as we hiked. Around us towered oaks of many varieties, together with hickories, maples, horse-chestnuts and tulip trees. In the valley ravines stood great cucumber trees and hemlocks. Beneath all these there was still enough light for dogwoods, witch hazels, laurels, azaleas and hydrangeas to thrive. The forest floor, too, was rich with herbs and ferns as well as lady slippers, trilliums, Indian cucumber root, Indian physic, galax, partridge berries, pipsissewa and rattlesnake plantain. Exposed rocks were covered with lichens; in other places, black humus had collected in deep pockets on the mountainside.

We were accustomed to silence, so we noticed the crunch of twigs and the rustle of leaves under foot as we walked. Not many birds were here, although we caught with undisturbed delight the occasional deep roll of a thrush, or the trill of a warbler. Earlier there had been a shower that wetted us; now the sky had cleared, and our clothes were dry. Our trail sloped easily upward, although below us the mountainside fell away rather steeply into a dark gorge.

Suddenly a sharp, piercing crack split the forest stillness. We reacted with the quick shock that lightning close at hand in the mountains produces automatically in the climber. But the sky was cloudless; not even a breeze stirred. The crack was quickly followed by others, growing in volume, a rending and smashing sound. The mountain ravine filled with reverberations, echoing and re-echoing up and down the valley. The rumble of falling rocks continued on down the gorge below.

Now sighting a narrow opening in the forest below us, we realized that we had been present at a great natural phenomenon—the fall of an aged, giant hemlock. On this bright morning, without rain or wind, it had lost its centuries-old grip on rocks and soil of the mountainside. As it had come to its catastrophic end, it had torn away masses of soil, rocks and roots, and cut a long swathe of branches, smaller trees, and shrubs in its downward path.

Then, complete silence in the forest. We were left alone to our startled thoughts.

The natural fall of a tree. It must be a common occurrence. Every ancient, undisturbed forest has its huge rotting logs. Many must have fallen this way. It is the process of Nature. But who has ever been present at the exact moment of this drama? My companion, the park naturalist, who had daily hiked in the woods for years, confessed that he had never before had this experience, although an old woodsman he knew had claimed to have heard and seen the phenomenon. Not even Thoreau records such an episode in his two years at Walden.

The fall of a tree in a storm, or shortly after, or by weight of snow, or even when struck by lightning—these are impressive events, notable when we witness them. And no matter how often we have seen a tree cut down, the call of "Timber!" and the sight of a great tree, slowly swinging into space and then plummeting with increasing speed to the ground below, always has its emotional impact on us. We are conscious of man's dominion over palm and pine. But, beyond this, the fall and death of an ancient thing, so long rearing itself in light, starts melancholy reflections. Yet all these incidents are artificial, slight, in comparison with the natural fall of a tree on a calm day. Then the slow conflict of Nature reveals itself in one of her supreme dramatic spurts.

Now, far below us, lay the long-dead hemlock, whose days of life, we estimated, may have endured for four centuries. As we resumed our climb, there was time for our thoughts to digest our experience. No other observation in natural history, not the sprouting of an acorn, not the study of an orchid in flower, had ever brought home to me so vividly the wonder of plant life and the process of Nature, as the fall of this dead hemlock that June day. While, centuries ago, the organizing principle of protoplasm that gives me my existence was scattered through many individuals on a far continent, the hemlock was already a living organism, a viable seed. Here on this very mountainside, so long ago, it nestled and grew.

Like all life, it began its unceasing struggle against the dead weight of inanimate matter. For the order, or controlled chaos, of physical nature is one thing. Life uses this order, but from it builds a new, a different order of its own, directly in opposition to the leveling influence, the tendency toward a stale equilibrium, which inheres in non-living matter. For help the plant draws on decomposed organic matter in the earth; but mostly it seizes directly on the energy of the sun, the force of wildly chaotic matter transmitted through light and heat. Steadily, as it lives and grows, building physical stuff into its life pattern by means of captured energy, the plant must struggle against the propensity of its own substance to return to the ordered chaos of cold matter.

A tree is never a static thing. Every hour, every day, through seasons and seasons, for years and centuries, this hemlock had been building its own structure, the order of life, against the pull of physical Nature. Cells of wood had risen higher and higher, flaunting the attraction of gravity. Roots had spread wider and deeper, gripping rocks and displacing soil, to hold in balance the towering bole. On and up this life had pushed, while in the outside world boys grew into men, generations came and departed, nations were born and died. The tree was life itself, the long-sustained, silent struggle of the forest.

But even this process was subject to time; it must have a stop. For with every pulsation of growth the tree was increasing its thermodynamic unbalance of the universe. Who knows what stops the growth of a tree; the precise manner, the exact moment, when death enters the heart? At some instant the drive of life flagged, the strength of inanimate forces, long successfully challenged, gained the upper hand. The hemlock had begun to lose its solitary battle. Was the reverse sudden, as in trees that seem to die over night? Or had this forest giant waged a long retreat, slowly dying by inches over many years, until the last mortal cell was extinguished? At this final moment, the tree had attained its full measure of reordering the universe, which is the historical record of life's triumph over matter.

But then the process of decay, of return to the deadly equilibrium of inanimation, set in. No longer did the roots strengthen their hold on the earth; the task of holding the tree upright, against the pull of gravity, was left to the dead woody tissues. Little by little, irreversibly, the forms of the roots shrivelled, sand and rock shifted beneath the huge hulk. Perhaps the growing root of some other tree tilted the balance slightly. Finally, one more dead cell lost its hold; the ultimate grain of soil rolled away. And the whole giant crashed to earth. The fall of this skeleton revealed the mighty forces of inanimate Nature that the tree so long had held at bay.

It was fate that brought us, short-lived men, to the spot at that exact instant. All our earthly runnings to and fro had led to this concatenation; to be witnesses of the woodland drama. But we were part of the drama, too. The same forces were at work in us, building up the order of life, increasing the potential of decay. We, too, were disturbers of the universe.

And yet the drama was not over. The fallen trunk would lie for years there on the mountain slope, gradually filtering from its side the dead organic material that would some day be taken up again to build the living order of yet other organisms. The round would be ceaseless; physical Nature does not rest.

As we moved on up the mountain that shining, memorable day, away from the uprooted hemlock, the green forest closed around our view. We knew we had never before felt so much a part of the great process of undaunted life.

I do not expect to hear again in my lifetime the natural fall of a forest tree. But I shall not now pass a dead fallen trunk without a feeling of respect, and kinship, for the life struggle recorded there.

The Rock Trail

By DANIEL SMYTHE

There is a path that is concealed
In the woods' shade beyond the field.

On banks beside it, we may learn
The moss, and polypody fern.

Within the creek there is a stream
That rings the jewelweed with its gleam.

Pale beechdrops glint, with Indian pipe;
The hemlock berries grow more ripe.

Where tiny checkerberries bleed,
The beggar's lice is scattering seed.

Along the shade the spiders' strings
Wave in the air, a sky that brings

The sound of thrush and mourning dove,
Or the cock pheasant far above.

With such a various life to see,
We probe the shade of rock and tree.

Dances Teach Nature Lore

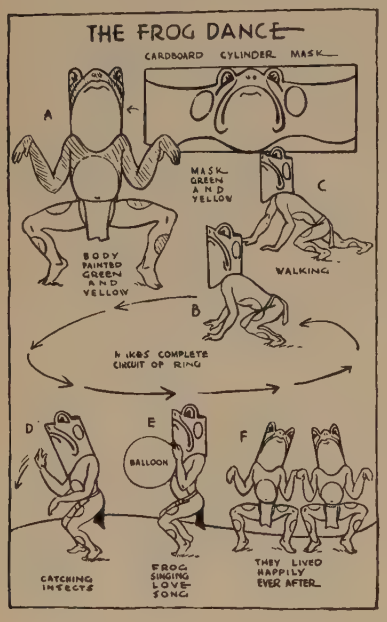
By ELLSWORTH JAEGER

SCHOOLS, camps, children's organizations, and other groups are always seeking ways and means of teaching Nature lore, and of furnishing entertainment at the same time, searching for ideas that are not difficult to present with materials easily secured. An answer to this quest is the masked animal dance.

Rhythm has been a part of life since the first pulse beat, and dancing has a history that is ancient indeed. The very heavens move in rhythmic sequence, and mammals, birds, and even insects have primitive dances. The pendulum swing of the courting humming bird, the grotesque mating dance of the sandhill crane, the strange circle dance of skunks and elks, all show a desire for rhythmic expression. Thus the dance was ancient when man first came upon the earth, and when he beat upon a drum he was beating a rhythm of his own heart.

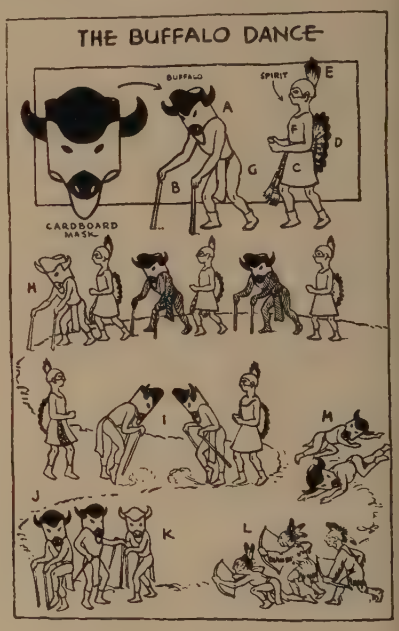
The Indian had many animal dances, some serious and some comic. While the masked animal dances here presented do not have the serious purpose of the Indian, we can use them for fun and frolic, as well as to teach the strange habits and actions of Nature's children. The use of a simple mask adds greatly to the interest, reality and charm of the presentation, and offers opportunities for creative skills.

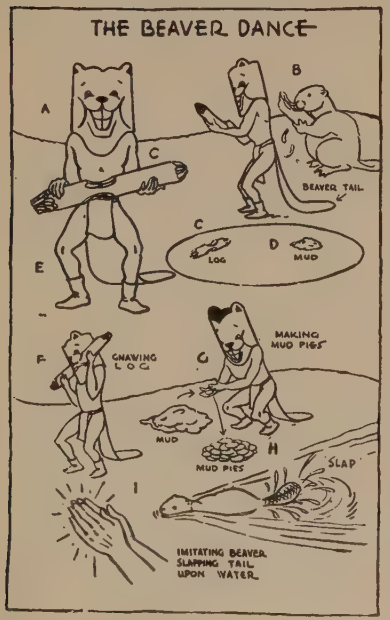
In the following dances only simple materials are needed for both mask and costume, and the Nature and arts and crafts departments work hand in hand. The only musical instrument needed is a drum, which can be made of a tin coffee can with a piece of old inner tube stretched tightly over it.



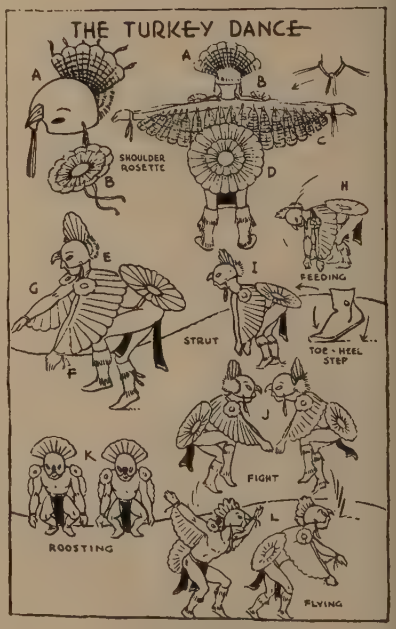
The Frog Dance requires two dancers with cardboard cylinder masks, and whose bodies are painted in yellow and green (A). One frog hops into the council ring and makes a complete circle of the ring (B). He then walks on all fours, as frogs sometimes do, (C), snapping up insects with his tongue, which is simulated with his hand (D). All movements are to the rhythm of the drum, which may be the "hard and soft beat," or a "march time beat."

The frog has a yellow toy balloon upon his person. This has a tube attached so that it can reach his lips through the mask (E). He inflates this from time to time and gives the bass "jug-o-rum" call of the bullfrog. He hops to various parts of the council ring, inflating the balloon, giving the call and peering here and there. When he is again opposite the entrance to the council ring he gives another "jug-o-rum" call, and the lady frog comes hopping in looking for the singer of this love song. Both come forward to meet each other (F). They hold hands and hop out of the council ring together.





The Beaver Dance has a lone dancer garbed in a cardboard cylinder mask showing the gnawing teeth of the beaver (A). He wears a brown-colored breech clout, with a short apron in front and a long rounded beaver tail dragging behind (B). A branch of wood with the gnawing marks of the beaver is placed in one section of the council ring (C). A quantity of mud is placed in another part of the circle. From this the beaver can make a number of mud pies (D). The drummer beats an introduction upon the drum and the beaver enters,



using the peculiar waddling gait of the beaver when walking on its hind legs, its tail dragging (E). He walks in this way once around the ring. When he nears the branch he picks it up and gnaws it (F), carries it a short distance and gnaws upon it again, going completely around the council ring. He then takes the branch and carries it to the center of the ring and leaves it.

The beaver now goes to the mud cache, makes a mud pie about one or two inches in diameter and carefully places it a little distance away upon the ground (G). He continues this until he has a little pile of mud pies (H). Again he waddles a few steps and claps his hands together to imitate the slapping of the beaver's tail upon the water (I). He does this several times and then leaves the council ring. The drummer beats a fast tattoo upon the drum. All movements in the dance are performed in rhythm with the drum.

The Buffalo Dance—To the Plains Indians, the buffalo or bison was the most important animal. It was a powerful medicine animal, too, and in the old days millions roamed the plains, furnishing most of the necessities of life to the Indians. Many of the tribes who lived in the buffalo country performed buffalo hunting dances to insure a good game bag. This dance is adapted from several of the original buffalo dances.

Nine or ten dancers are needed. One dancer impersonates a white buffalo, an albino animal sacred to the Indians. Two other dancers represent the ordinary brown animals. There are three buffalo spirits, one of whom dances behind each buffalo. And, last of all, there are three buffalo hunters.

The white buffalo is painted white, wears a white headdress or mask, white breech clout or kilt (A). The two other buffaloes are painted brown and wear a dark brown mask or headdress, and brown breech clouts or kilts. Each buffalo carries two sticks (B). The buffalo spirits wear kilts or breech clouts (C), and a bustle representing the sun at their backs (D). They also wear a fan of feathers at the back of their heads (E). Their faces and bodies are painted in contrasting colors (F). For instance, the face may be painted vermilion and the body blue or green. A spirit follows each buffalo, dancing at its rear.

The drummer beats a loud tattoo upon his drum. He then beats a fast march time and the white buffalo and spirit enter and trot around the ring. The white buffalo holds up the two sticks (his forelegs) as they trot once around (G). When they pass the entrance the two brown buffaloes and spirits follow behind the white buffalo and dance once around again (H). Then the white buffalo and spirit dance to the center and the brown buffalo bulls face each other, lower heads in mock challenge, paw the earth, snort and dance past each other entirely around the ring until they again face each other and repeat pawing, etc. (I). The spirits dance behind each buffalo.

The white buffalo, meantime, walks around the fire, using his sticks as forelegs, followed by the spirit. Then the white buffalo gets uneasy, moves toward the entrance, sniffing the air, and dances away frightened. The other buffalo dancers also become uneasy, face the entrance, and finally dance to the opposite side of the ring (J).

Hunters now appear, stalking, trying the wind, testing bows and looking for tracks. The buffaloes now dance excitedly, snort, paw the ground and move away from the hunters (K). The hunters are now aware of the game, and tensely follow with strung bows (L). When the buffaloes near the entrance the hunters leap to their feet, shout and twang their bows, and the buffaloes drop at the entrance (M). The spirits dance around them. The hunters yell and dash forward, but the buffaloes jump to their feet and all run out of the council ring.

The Turkey Dance—The turkey is one of our

present-day domestic fowls, a native of the New World. The Indians hunted it wild, but some of the tribes of the southwestern United States and Mexico had already domesticated this bird long before the coming of the white man. It was used for food, as well as for ceremonial purposes, the tail feathers being considered to register the various water marks of floods and rains. And so it is quite fitting that we should have a turkey dance in tribute to this bird.

Two turkey dancers usually present the dance. They wear a fan headdress of turkey tail feathers at the back of the head and fastened to a red cap (A). A turkey beak, carved out of wood, is fastened to the front of the cap. They also wear small rosettes of feathers on their shoulders (B), and "wings" of feathers attached to a narrow cloth band fastened at the wrists and around the throat (C). An elaborate bustle of turkey tail feathers is fastened to the belt at the back of the dancer (D). The face and neck of each dancer is painted red to match the color of the red cap, and to simulate the turkey's red head and wattles (E).

The turkeys make a gobbling call as they enter the council ring, and walk in with measured tread, lifting their legs and placing their feet carefully upon the ground as turkeys do (F). They then try their wings and move them as in the heavy flight of the turkey (G). Occasionally they seek food and move their heads as if pecking at things (H).

Then, using the "toe-heel" step, they strut about with bodies bent forward and wings dragging (I). Whenever they meet they leap high in the air as if fighting (J). They repeat this two or three times. Finally night comes and they seek out a roosting place, moving sideways together with short steps, to the left and then to the right, wings held down and figures hunched (K). They go to sleep. After an interval they awaken, crane their heads here and there and then slowly fly out of the ring (L), all to the measured beat of the drum.

The Wolf Dance—The wolf was greatly admired by the Indian for his sagacity, his hunting ability and his endurance. In fact, the Indian scout was called a "wolf", and the sign for both was two fingers spread apart, symbolizing the erect ears of the wolf. The wolf was considered a great "medicine animal," and the Indian scout wore the skin and head of the wolf when on a scouting expedition.

Five or six dancers comprise the "pack" in the wolf dance. A lone deer dancer is also included in the group. The wolf dancers may wear two types of masks, the half mask made from the crown of an old felt hat (A), or the cardboard cylinder mask (B) shown. The dancers wear breech clouts or kilts, and have a tail attached at the back (C). The deer wears a deer mask with antlers, and a deer's tail attached at his belt at the back (D).

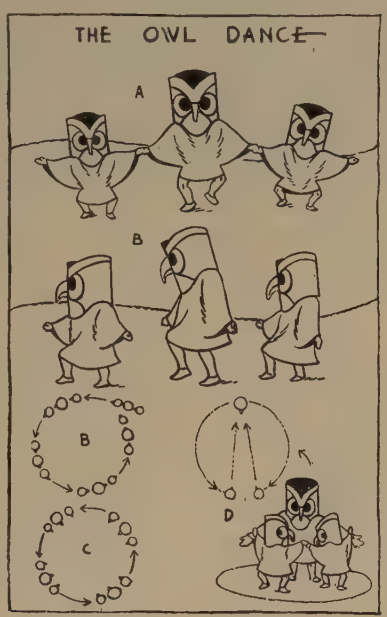
As an introduction to the dance, the Sioux Wolf Song, as described on page 78 of the *Indian's Book* by Natalie Curtis, may be sung, or a few long-drawn-out wolf howls may be given by the wolves outside the council ring. The wolves then dance into the ring, using the toe and heel step, moving here and there, sniffing and investigating (E). They divide into two pairs and dance together (F). Next the wolves join together again in pack formation, and dance in single file once around the ring (E). They then sit in a circle. From time to time an individual wolf jumps upward and howls; the whole pack answers. Repeat this two or three times (G).

The pack then jumps to its feet and dances to the side opposite the entrance to the ring. As they reach this spot the buck deer dancer prances into the ring, suddenly stops, and snorts in fear (H). The wolves also halt and stare toward the buck. Then, with a series of hunting howls, barks and whines, the wolves chase the deer around the council ring and eventually surround the buck (I). The individual wolves rush at the deer and past him. The deer fights back, but suddenly the whole pack attacks at the same time. They pull the deer down and carry him out of the council ring with a series of hunting howls.

The Skunk Dance—The cast consists of two Indians and a little skunk. The skunk may wear a cardboard mask and black gown with the characteristic "V-for-Victory" white stripes down the back (A), or this dancer may be painted in black and white, wearing a headdress as shown in (B). The skunk daintily carries a large cardboard flower, and large grasshoppers, beetles and grubs are cut out of card-

board and used to add drama to the dance (C).

The little skunk dances into the council ring, and around, with little skipping hop-steps, carrying the large cardboard flower, painted in bright colors on both sides (D). He holds the flower to his nose occasionally. He dances here and there, and stops at intervals to sit and sniff the air with upturned nose (E). He investigates various parts of the council ring, digging into the ground with his forepaws (F). From time to time he finds a cardboard grub and makes a show of eating it, then casts it aside. At different places in the ring he finds grasshoppers and beetles (made of cardboard), and also eats these in pantomime (G).



While he is thus occupied, two Indian braves, bright in war paint and trappings, dance nonchalantly into the ring, with one hand upon their hips, conversing pleasantly with each other in pantomime (H). They dance around in this way until they near the skunk, who is busily eating. They stop suddenly, sniff the air and then make a show of holding their noses as they look here and there to discover the source (I). They spot the skunk and look much upset, slowly backing away. The skunk raises his head and sees the Indians. His curiosity is aroused and, being a friendly soul, he dances lightly toward them (J). The Indians back away, greatly disturbed, and the skunk, annoyed by their unfriendly actions, gets down on his hands and knees and drums upon the ground with his hands. He then turns his back upon the Indians and raises his tail. The Indians dash wildly out of the ring (K). The skunk rises to his feet, looks after the fleeing Indians, shrugs his shoulders and raises his arms with a gesture of indifference, picks up his flower and dances lightly out of the ring.

The Dance of Fallen Leaves—This is a story of autumn as the Indians saw it. The mythical magician "Nanabojou" is the chief character in the dance. In addition there are six "Fallen Leaves" dancers and six "Snowflakes" dancers, plus one who personifies "Spring." Nanabojou is dressed in a brilliant Indian costume of scarlet, yellow, tan and green, and wears a long trailer bonnet with medicine horns attached. He carries a peace pipe (A). The Fallen Leaves dancers wear short cloth jerkins upon which colorful autumn leaves are sewn. They wear caps covered with colored leaves, and carry small burlap bags filled with leaves (B). The leaves may be real autumn leaves, or they may be of colored paper. The "Snowflakes" are dressed in short, white, cloth costumes and carry white bags filled with torn pieces of white paper.

Spring is dressed in soft green and carries a number of flowers, real or paper (D). A soft thumping of the drum introduces the dance, after which Nanabojou dances nonchalantly into the ring holding aloft the smoking peace pipe (A). He dances into the center of the ring, taking a few puffs at the pipe. He blows smoke in the four directions and says loudly: "The smoky days of Indian Summer are come. The smoke from the Great Spirit's pipe is wafted over the land. Let us enjoy the warm, blue days of Indian Summer for soon the ashes of the pipe will grow cold, the fallen leaves will dance in the wind, and the white ashes of a season dead will cover the land in a shroud of white."

Nanabojou then turns the pipe upside down, knocks the ashes from it (E) and sinks softly to the ground in deep sleep (F). When Nanabojou slumbers the Fallen Leaves dance into the ring as if blown about by gusts of wind. They laugh and softly shout, and as they dance they scatter colored leaves about and over the sleeping Nanabojou (G). Circling thus twice around the ring, they leave with a final fling of colored leaves.

After a short interval of silence, the drum begins a soft, muffled beat and the Snowflake dancers come in lightly and silently, throwing high into the air handfuls of white paper snowflakes (H). Circling twice, they, too, leave.

There is a deep silence, and then a rhythm is created with a few small tinkling bells, becoming louder as a number of rattles join in the beat. Spring dances lightly into the council ring, looking here and there for the sleeping Nanabojou (I). Spring at first touches him softly. When there is no response she shakes him. Nanabojou stirs, awakens, stretches and yawns. He looks up sleepily. Spring motions him to arise and follow. Nanabojou slowly gets to his feet and now the bells and rattles become louder and Nanabojou follows Spring, dancing in the same light way he first danced into the ring. Holding up his pipe, he and Spring dance out of the ring together (J).

The Deer Dance—Six dancers are needed for the deer dance—a buck, two does, two fawns, and an Indian hunter. The buck wears a cardboard cylinder mask with antlers, a kilt with a deer tail attached at the back, and short leggings that come below the knees (A). The does wear identical deer masks without antlers, a long, brown shirt dress and short leggings (B). The fawns wear deer masks without antlers, and brown shirts that come just above the knee. The shirts are spotted with white paint to resemble the fawn's spots (C). The hunter is dressed in feathers and Indian cos- (Continued on page 442)

Boiling Springs

By JOHN LINDSEY BLACKFORD

Photographs by the Author

Sapphire Pool in Yellowstone National Park at the beginning of an eruption. Note the biscuit-like formations surrounding it.

ACTIVELY boiling hot springs are commonly associated with regions of past or present volcanic disturbance. Thermal springs, boiling or quiescent, and geysers, which are boiling springs of a special type, receive their heat usually from cooling, subterranean, igneous rocks. Ground waters, seeping downward through cracks of the upper bedrock, contact steam and gases rising from the hot masses below and, when heated, return to the surface. Often this occurs violently, depending upon the degree of heat, the nature of the underground system of fissures, and the proportion of magmatic waters and gases.

Boiling springs themselves are transitional forms between hot springs and geysers. They may simmer quietly, or boil with greater or less turbulence. In some cases the boiling is strong and continuous, in others intermittent and irregular. Still others, exemplified by marvelous Sapphire Pool in Yellowstone National Park, exhibit regular periods of eruption—violent boiling—and of repose.

A gradual rise in the surface level of Sapphire, followed by numerous gas bubbles rising through its translucent, blue waters, announces an eruption. Soon more gas reaches the surface, transforming the central portion of the pool into a seething, frothing fountain of great beauty that may mount to a height of several feet. A cloud of hot vapors now almost obscures the spring. This performance is repeated about every twelve minutes.

Attendant overflow and subsidence give to this variety the name of pulsating or breathing springs. Clusters of olive-green, biscuit-like knobs, which distinguish the surrounding formation at Sapphire Pool, suggested the name of Biscuit Basin for the area. They are dependent upon the ebb and flow and the mineral deposition from its limpid blue waters.

Avoca Spring in Yellowstone, where boiling is continuous around the curious formations built up at the center.

Nearby Avoca Spring displays constant activity. Boiling is continuous around the curious formations built at the center of the elongated pool. Steam rises without interruption. At brief, more or less regular intervals, boiling attains a peak of violence, overflow increases slightly, and then activity again diminishes.

Firehole Spring and Firehole Lake in the Park represent another, rarer manifestation of subterranean energy. In them, bubbles of superheated steam, rising from their depths, unite near the surface to form a quavering, light-blue "flame," resembling in shape and appearance that of a Bunsen burner. The constant repetition of the phenomenon keeps ever-lighted these beautiful, eerie, underwater torches.

As long as the flow of a spring is in excess of evaporation through boiling at its surface, overflow is maintained. Its waters retain their transparence, appearing usually deep blue or green. But if in- (Continued on page 444)

At the left is one of the larger kangaroos, and, at the right, a rare rock wallaby, one of a small colony found in a remote section of the Australian Alps. Once numerous, these marsupials were the victims of diseases imported along with cattle.

Rock Wallaby Remnant

By LEN BARKER

A SMALL colony of rock wallabies—an almost extinct species of marsupial—has been discovered in a wild and virtually unexplored region of the mountainous southeastern corner of Australia.

Hidden in dense undergrowth among the jagged peaks and deep gorges of the continent's highest mountain range, the Australian Alps, the rock wallabies were discovered by a party of scientists from the National Museum at Melbourne during the course of an ecological survey of the region surrounding the headwaters of the Snowy River. Numbering about fifteen, the colony is the only known remnant of what was once a plentiful and distinctive species.

Although resembling normal types of kangaroos and wallabies in general appearance, the rock wallaby has features peculiar to itself. Less than one-third the size of a mature male kangaroo, its average height is about twenty inches, while its length from tail-tip to skull is only forty-two inches.

The most outstanding feature of the rock wallaby's anatomy is his extraordinary tail, which is long and bushy, and, unlike the kangaroo's smooth tail, does not taper to a fine point. The rock wallaby uses his tail only to give the balance necessary to enable him to leap from rock to rock with the skill of a mountain goat. The tails of all kangaroos are highly developed, and often serve as an extra leg.

Another unusual feature of the rock wallaby is the broad feet, which have thick pads covered with rough skin, which helps the animal to obtain a secure grip on rocks. These pads are so rough that the porphyry rocks usually present in the wallabies' habitat have a high polish from contact with the animals' feet.

In the early days of Australia's settlements and even up to forty years ago, there were large numbers of rock wallabies. Within the space of two seasons, however, they fell to near extinction—victims of diseases brought to Australia by cattle and other domestic animals from Europe. Because of its frail build, the rock wallaby was unable to resist those diseases, as did the larger and more hardy types of Australian marsupials, which managed to develop comparative immunity to them.

Today, apart from the newly discovered colony, the only known rock wallabies in Australia are a few that have been kept as pets in a private zoo at the Jenolan caves in the Blue Mountains of New South Wales.

Leader of the National Museum's expedition was Charles W. Brazenor, well-known Australian mammalogist, who has taken part in many expeditions to little-known regions of the continent.

The recent expedition to the headwaters of the Snowy River was primarily to obtain an ecological record of the area before the headwaters of the Snowy are diverted as part of a great irrigation and hydro-electric project that may be put into operation in the near future. Mr. Brazenor was also interested in investigating reports that rock wallabies existed in the area, which, because of its jungle-like terrain, had seldom been entered by man and is classed as perhaps the roughest country found in Australia.

To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

Constellation Boundaries

By ISABEL M. LEWIS

Naming most of the constellations dates back to the remote ages, and their boundaries were either non-existent or ill-defined. Many early maps showed mythological figures, giants and warriors, a host of zoological creatures, and many inanimate objects or geometrical figures, all in haphazard arrangement. Bright stars were frequently located in heart, head or foot of some mythical creature. Antares was in the heart of The Scorpion; Regulus in the heart of The Lion; Aldebaran in the eye of The Bull; Betelgeuse in the right shoulder of Orion; Castor and Pollux marked the heads of Gemini, The Twins.

The constellation of Coma Berenices, Berenice's Hair, was added about 200 B.C. There were no more additions until the 17th century, when the astronomers Hevelius and Bayer and others filled in regions of the southern heavens, which had been uncharted up to that time, with many newly created constellations. Some of these were never generally recognized, or have been dropped or replaced by others on modern charts. Thirteen constellations in the southern hemisphere were added by La Caille a century later. He also subdivided the huge constellation of Argo Navis in the southern hemisphere into Malus, The Mast, now replaced by Pyxis, The Compass; Carina, The Keel; Puppis, The Poop, and Vela, The Sails.

The first boundaries of constellations were outlined by Bode at the beginning of the 19th century. These did not receive wide recognition, however. Later atlases and star maps showed different boundaries, and it was not unusual for a star to be listed in different star catalogs as belonging to two different constellations. This led to errors and confusion in the identification of some stars, and it was proposed from time to time to define more exactly the boundaries

of the constellations, which was certainly good sense.

The astronomer B. A. Gould was the first to adopt a simple and convenient plan of defining the boundaries between constellations in his catalog of stars of the southern hemisphere (Uranometria Argentina mapas, 1877). The lines that Gould chose for these boundary lines were hour circles passing through the north and south poles of the celestial sphere and circles of declination, which are parallel to the celestial equator. They correspond to our meridians and parallels of latitude on the earth, and, as is well known, boundaries between states or countries are often coincident with these lines on the earth's surface.

If hour circles and circles of declination are used as boundary lines for the constellations, the position of a star in any constellation is permanently fixed with respect to the boundaries of the constellation. Due to the procession of the equinoxes, however, the positions of these boundary lines on the celestial sphere, as well as the positions of the stars, will not remain fixed in position with respect to the celestial equator and poles of the heavens, although the stars in a constellation remain fixed with respect to its boundaries.

The positions of the boundaries of the constellations in Gould's catalog of stars in the southern hemisphere was for the epoch 1875, January 1. In a period of fifty years slight changes would be noticeable on ordinary star maps and atlases in the positions of the boundary lines, as well as in the positions of the stars with respect to the equinoxes. Star atlases are revised from time to time to take care of these changes.

Some thirty years or so ago certain astronomers, among them E. Delporte at the Royal Observatory of Belgium at Uccle, were impressed with the fact that many advantages would result from having a uniform system of constellation boundaries adopted. There was at that time, and still is, an International Astronomical Union, which held meetings every three years. These meetings were interrupted by World War II but were resumed with the meeting this year at Zurich, Switzerland, on August 11 for the consideration of problems of general interest to astronomers of all countries.

It was as far back at 1923 that a National Belgian Astronomical Committee examined the question of defining new limits for the northern constellations. At the request of this Belgian committee The International Astronomical Union, which met at Cambridge, England, in 1925, took up the consideration of the question of revising the boundaries of the northern constellations.

The General Assembly of The International Union decided at this meeting that it would be useful to have such a revision made, and a Commission of Notations was appointed to consider the matter and to report at the next meeting of the Union, which was to be held at Leiden in 1928. At that meeting the recommendation of the committee that had been appointed to consider the matter was to adopt new boundaries for all of the constellations north of 12½ degrees south of the equator. The new boundaries were to be hour circles and circles of declination, as were those adopted by Gould for his southern constellations.

A grant to cover the cost of publication of a new atlas, which should show the new boundaries, was also approved. Mr. Delporte, who had given much time and thought to the problem, prepared a manuscript table giving the newly defined boundaries, and these were carefully examined by astronomers of the Yale Observatory to make certain no change in the designation of any variable star would be made and that a minimum of stars would be moved to other constellations. Only a few minor changes were suggested for these reasons. Mr. Delporte then sent the manuscript of a volume entitled, *Delimitation Scientifique des Constellations*, to the General Secretary of The International Astronomical Union. It was accepted by the Union and published by the Cambridge University Press in 1930. Following the suggestion of the President of the Commission it included all of the 88 constellations, and extended from pole to pole so as to cover the entire heavens. Not only tables defining the limits of the constellations were given, but charts that showed the positions of stars down to the sixth magnitude as well as the positions of the boundaries.

A second book by Delporte was also published in 1930, bearing the title of *Atlas Celeste*. Charts of the constellations, showing the new boundaries with the positions for the equinox of 1875, which were those of the Gould Catalogue, also appeared in this publication. It contained, in addition, positions of all stars in the constellations down to 4½ magnitude for both 1875 and 1925 so that positions for later dates could be easily obtained. Positions of variable and double stars and nebulas and much other useful information was also given.

All modern star atlases (Continued on page 444)

Olympus

By MARGARET MITCHELL BERRYMAN

Charioteer of the sun, Phoebus the proud,
The doughty Atlas, who the earth upholds,
Zeus invincible—in such mythic molds
Were shaped the gods of old, with might endowed
By ancient concepts of heroic power.
Today, not gods, but men, on Palomar,
Through patient industry, have struck the hour
That spans the billion light years of a star,
And brings the vast empyreal of space
Into man's ken. Not the research profound
Which split the atom that destroys the race,
But *this* the triumph—*this* the century crowned!
Mortals have climbed Olympus, there to see
Cosmic radiance, and touch infinity.

Camera Trails

By EDNA HOFFMAN EVANS

As you enter the sands and drive for perhaps a mile or so through them you can witness the battle between sand and vegetation.

HAVE you ever found a place that seemed so ideal for photography that you actually felt "trigger happy"?

By "trigger happy" I mean, of course, that uncontrollable desire to "shoot" pictures of everything in sight. You get so excited and enthusiastic that you want to aim the lens of your camera in every direction at once. You take picture after picture, as fast as you can, until either you or your supply of film is exhaused. Usually, both happen at about the same time.

As for the results of such a photographic binge, more will be said of them later.

I found just such a photographer's paradise this past summer. As is often the case, I had heard of the beauties of the place from friends, had listened with a mentally lifted eyebrow, and arrived expecting to be disappointed.

But I was not disappointed. I went trigger happy, too.

Where is this place? It is called White Sands Desert and it is down in the south-central part of New Mexico, less than a hundred miles north of El Paso.

What is so fascinating about it? Imagine a stretch of pure white sand, nine miles wide and more than 60 miles long, gleaming in the sunlight. The sands lie in a valley known as the Tularosa Basin, with ramparts of purple mountains marching in the distance along either side.

Seen from a distance—and you can see them from the mountain slopes many miles away—the sands gleam like quicksilver, or like some gigantic heliograph signal, in the sunlight. Dust devils dance across the long plain between the mountains, red where the whirling dust columns are sucked aloft from the sun-baked earth of the valley, and silver-white when the whirls touch the edge of the White Sands.

Along the margin of the sands, and for perhaps a mile or so as you follow the winding road through them, you can witness the battle between sand and vegetation. Tall yuccas thrust determined heads up through the whiteness and bloom. Dry-looking grass holds forth in stubborn tufts, and sand verbena adds its lavender flowers to the parched growth of a few other members of the plant kingdom. But, as one goes farther and farther, the sands show more and more victorious so that, botanists have found, only seven of the sixty-two different plants found in the Tularosa Basin can hold their own within the sands.

As for photography—why go trigger happy there?

The sands are not flat. Dune after dune rises endlessly, twenty feet, thirty feet, sometimes fifty feet—stretching in long rolls, in sugar loaf-shaped mounds, in crescents, in waves, in every conceivable arrangement and pattern. This dune has smoothly rounded sides, as though some giant's child playing at sand castles had built it. This one drops off sharply, curved on one side and smoothly angular on the other.

Wind is the architect that has designed the dunes. Wind is the workman, the mover, the artist that is continually changing them. This mound shows wind ripples on its surface, as clearly as sand at the bottom of a stream shows the marks of flowing water. On that smooth surface you can see the lacy footprints of a desert mouse, or the circular sweep of a wind-blown yucca leaf. All this can be captured with a camera, at the right time.

The right time is morning or late afternoon, especially the latter, since the western slopes of the dunes are sharper and the resulting shadows are more spectacular then. There are many fascinating picture possibilities in the gleaming white of the sun-touched slopes and the contrasting darkness of the shadows. One does not fade into the other. Instead, there is a sharp line of demarcation that is startling in its abruptness. Slanting afternoon sunlight brings out the ripple pattern on the sand, etches the lacy mouse tracks and casts fantastic shadows behind the yuccas.

For a photographer who strives for "effects" the possibilities are endless. He can take a panorama, as much as he can encompass with his lens of mountain background, sharp-shadowed dunes and cloud-studded sky. He can limit his picture to a single valiant yucca head, thrust determinedly upward from a dune like a swimmer's hand from a wave-crest. He can confine it to a patch of ripple pattern or a few of the lacy footprints.

Black-and-white photographs are striking since they bring out the contrast of light sand and dark shadow. But color pictures of the sands are beautiful, too. Most of them, correctly exposed, are symphonies (or should we say rhapsodies) in blue. There is blue in every shadow, a bluish-silver tint to the sands, blue-violet in the mountains, azure in the sky, and blue-green tints to the vegetation. Do not be mistaken; there is plenty of color in White Sands, in spite of their eye-aching whiteness.

Nor does the beauty stop with sunset. At night, under a full moon, the sands become a stretch of fairyland. Photography is possible even then, and contrasts of light and shadow are even sharper. However, the black-and-white photographer will have difficulty in convincing people that his night time-exposures were not taken in broad daylight.

If you cannot visit White Sands this year, or next, do not fret. Years from now they will still be waiting for you. Fortunately a portion of the desert, an area covering some 140,247 acres, has been set aside as a national monument, and will be preserved in its natural state indefinitely.

White Sands, as every well-informed high school boy should be able to tell you, is the place where the first atomic bomb was tested, while the nearby Alamogordo bombing range is the scene of numerous rocket trials. This area, however, is some distance from the national monument, so there is no

Valiant yuccas thrust determined heads upward through the sand and bravely bloom.

need to include a Geiger Counter amongst your equipment.

It could be nice if I could blame atomic radiations for the poor showing I made with my White Sands photographic binge. But, unfortunately, I have no one to blame but myself. Of all the photographic boners possible, the only thing I did not do was get my thumb in front of the lens. And, considering the type of camera I was using, I would have to be a contortionist to do that.

To begin with, I arrived at high noon, with not enough time to wait for proper shadows. I got excited and shot fast, which does not contribute to camera steadiness or pinpoint sharpness. Then, to top it all off, I forget to pull one tab early in the film pack. As a result, I had nothing but blank negatives from there on back.

Still, I got a couple of usable pictures, and a lot of excellent experience as to what not to do next time. Here is hoping that experience stays with me when next I start going trigger happy.

Scientifically speaking, the White Sands are a geologic oddity. The vast white area is not sand at all, it is gypsum, and gypsum is the material from which plaster-of-paris is made. In its rock state it is called alabaster.

For millions of years, geologists say, rains and melting snows have washed the gypsum particles from the mountains into the Tularosa Basin. Wind has done the rest, evaporating the water and heaping up the rolling dunes. And the dunes do roll; they rise and disappear again like super-slow-motion ocean waves, as the aeolian architect works endlessly on them.

At various places in the desert one can find harder columns, almost rock-like, to show where plant roots have held the white particles together, allowing them to resist for a longer time the relentless force of the wind. Such formations make striking pictures; the ones I photographed are among those that turned up missing.

It is well to take a filter along, or a series of filters, for really striking pictures. Deep red will turn the blue sky black and make the sand all the whiter. Orange will bring out the shadows. Yellow or green give a softer, less spectacular result, but will sharpen the effect of the shadows. A lens shade is advisable because of the glare, and the photographer should wear dark glasses unless he prefers to squint endlessly.

It is a funny thing, though, that no matter how hot the sun is—and in July when I was there the midday sun was really hot—the sands remain cool. One can walk barefoot over them in comfort. The gypsum, much finer than ordinary beach sand, feels cool and soft underfoot.

The White Sands are silent, brilliant, awe-inspiring. Still, they are not terrifying like other deserts. One could not become hopelessly lost in them for, right and left in the distance, the purple mountains march—perfect landmarks for the desert visitor.

FILM GUIDE

Extremely appropriate for the start of another school year is the new (1948) eighth annual edition of "Educators Guide to Free Films," compiled by Mary Foley Horkheimer and John W. Diffor, and published by the Educators Progress Service, Randolph, Wisconsin. This edition lists 1632 titles of films, of which 500 were not included in the previous guide. It also lists 242 slidefilms, of which 105 are new. Among the titles in the biology section, interesting sounding ones include "Canoe Trails Through Mooseland", "Home of the Buffalo", "Hunting Without a Gun" and "Making Friends With Wild Life." All four, incidentally, plus many more, are from the National Film Board of Canada. I would say the guide is a "must" in any school's visual education program.

The Du Pont Company has released a 32-page booklet called "The Real Pleasure of Photography", telling how to take a good picture and then develop the film in a home darkroom. The booklet sells for 25 cents at photographic supply shops.

Here is an interesting item—an exposure meter you can wear like a wrist watch. It is called the "Patrol" and is obtainable from Warren-New York, Inc., 3310 34th Avenue, Long Island City 1, N. Y. Its price is $16.50.

EXPERIENCES WANTED

So much for the photographic delights —and woes—of my 1948 summer trip. Readers, why not write and tell other "Camera Trailsmen" of how you fared photographically during the summer?

Introducing Color

An Introduction to Color. By Ralph M. Evans. New York. 1948. John Wiley and Sons. 340 pages. Illustrated. $6.00.

Color affects a wide variety of people in a multitude of different ways, and it is fundamentally of interest to almost all of us. As the author, who is head of the Color Control Department of the Eastman Kodak Company, points out: "Color sprawls across the three enormous subjects of physics, physiology and psychology." Since, in the past, intensive workers in color have had little opportunity to understand all three phases of color's impact, this present book has been written to fill in the gaps. While of special value to the worker in and with color, this book is, nevertheless, of general interest to the average reader. It is clearly written, without over-simplification of a subject that must be thoroughly treated. The author has been gradually working toward the volume over a period of years.

Slidefilms

Latest addition to the "Science Adventures" series of discussional slidefilms prepared by the Jam Handy Organization, 2821 East Grand Boulevard, Detroit 11, Illinois, is titled "Water Life." It comprises seven slidefilms in color. These are designed for science class work in grades 4 to 8, for biology classes in junior and senior high schools, and for oral reading classes, and are equally interesting to groups interested in outdoor subjects.

Flower Week

Under the sponsorship of the Society of American Florists, the week of November 7 to 14 has been designated as National Flower week. This is not designed to be a sales promotion period but, rather, a period in which to acquaint the American public with the beauty and sentiment of flowers as well as little-known facts about their production.

The School Page

By E. LAURENCE PALMER

Professor of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

FLIES IN SCHOOL

Some day I hope that Mr. Gallup will conduct a poll to discover if there are any citizens in the country who, at some time in their school experience, have not deserted the offerings of textbooks, courses of study and teachers for the more intriguing and real study of flies in the schoolroom. Heartless little boys have pulled off the wings of flies so that the insects may crawl more irritatingly over the necks of little girls in nearby seats. Wonder has been aroused by the varying ability of different kinds of flies to alight bottomside up on a ceiling from the flying position. Some may have noticed that some kinds of flies are to be found active in the sunnier parts of the room while others seek greater seclusion. While the teachers have attempted to show the glories of ancient Rome, and to suggest significance in Greek architecture to unimpressed students, few teachers have ever noticed the glories in the iridescence of a syrphid fly, or themselves appreciated the significance of the behavior of a cluster fly. Most teachers and pupils, alike, have assumed that little flies grow into big flies even though they may have had enough entomology to recognize that an animal whose skeleton is outside must develop differently from those who can merely hang a few more pounds of flesh on a framework of bones. True, many of the crustaceans with outside skeletons do increase in size even after sexual maturity has been reached, but this is not the system followed by the subject of this month's special insert.

Teachers who seek to avoid the teaching of Nature study because they have no materials with which to work, find it difficult in the autumn months to use this argument when it comes to the study of flies. I have found flies in schoolrooms in every month of the last year. The animals were active; made significant responses to conditions that I changed. The supply was adequate at almost any time. There was ample variety. Reasonable study would be suggestive of such varied subjects as health, economy, esthetics, history, geography, politics and many of the aspects of science.

Earlier, in these pages, we have suggested the use of glass coffee jars for controlling conditions that may influence the activity of flies. Fastened together by their perforated tops, the bottles may constitute little adjacent climates, which flies may be seen to avoid or to seek as suits their interests. Light may be admitted or excluded, or colored, intensified and made intermittent as suits the wishes of the experimenter. Temperature may be changed and measured, and its effect on fly behavior may be interpreted. It is easier to change the humidity in a glass jar than in a township, and yet the effect on organisms may be the same. What more can the teacher or student with an investigative turn of mind require?

The rearing of some fly through a single generation, and the appreciation of the types of reproduction, suggest worthwhile activities with flies in schoolrooms. In spite of what some of the standardized tests might have us believe, all flies do not spend their larval stages in horse manure. There is probably not a schoolroom in the land on whose windows do not appear, at some time in the year, some of the larger, buzzing blowflies, whose crushed bodies yield living, squirming maggots rather than relatively inert eggs. The reasons why those species whose larvae must live on perishable substances, such as carrion, should have developed the habit of omitting egg incubation outside the parent may be obvious. It suggests a worthwhile investigation be made of myriad flies that are swatted at many times and in various places. How many extrude eggs, how many free living larvae, and what does the particular habit found suggest? No teacher can object to a suggestion such as this if it leads to a better understanding of the role flies play in the general scheme of things. No teacher can claim that the opportunity for such study has never presented itself in her schoolroom at any grade level.

There are possibilities that some children may recognize the preferences flies—such as mosquitoes, deerflies and horseflies—have for different individuals and for any individual under different conditions. They may observe that at certain times of the day mosquitoes and other flies that may be found in the house seek the screens, where they may be killed more readily than at other times. They may observe that some flies are to be found not only at relatively limited times of the day but at equally limited times of the year; that while a few fly sluggishly others dart with dazzling speed or with startling change of pace and direction. Usually these variations in flight habit are associated with variations in food preferences, and the reasons may be obvious even to children.

The psychological changes that seem to take place with horses, cattle and humans, when they are threatened by certain flies, and their apparent unconcern about the presence of others, may have been observed by many rural youngsters, or by others who have had occasion to work with domestic animals. A similar reaction has probably been observed by bathers at the most select beaches when some of the large horseflies or green-eyed monsters make unannounced and unwelcome invasions of places where bathers congregate. Children may notice the varied tendency of some of these flies to attack human flesh that is wet, and human flesh that is dry.

Why these differences exist probably cannot now be explained, but there may be reason to believe that interpretation of this sort of thing may bring about desired controls and improved relationships between man and the flies involved. Whether persons exposed to the persistent attacks of flies, such as blackflies and mosquitoes, develop an immunity to them may be worth superficial investigation. It is certain that individuals bitten by some of these flies do not suffer or become inflamed to the degree that others do, and equally certain that, as the season progresses, an individual may seem to be disturbed less by the beasts. Whether this is a matter of a developing immunity or a change in the insect population is another question. In the Adirondacks they say that when the blackflies put on their white stockings they do less damage, overlooking the fact that the "white-stockinged" animals are a different species from their more villainous predecessors. This little observation, of course, suggests a new fly study project in which one makes representative collections of flies found in different months of the year, at

Heritage of the Ant

By HOLLIS ARNOLD

Obscured beneath the leaves,
Of summer's late demise,
In microscopic vaults,
A hidden kingdom lies.

Where caverns teem with life,
In industry eternal,
Constructing piles of grain,
And storing every kernel.

Intrinsic socialists,
Existing for the state,
They have one aim in life.
And care not what their fate.

Automatons organic,
Predestined slaves of toil,
Their one and only boast
Is of ancestry, royal.

different places and even at different times of the day in different places. Such a study would lend itself well to the chart technique so popular with some school teachers. Certainly it would be as significant as some of the charts made to show seed dissemination, plant geography or bird migration. Flies force themselves on us, and influence our health too much for us to continue to ignore them, in school or out.

Forest Booklets

"Know Your National Forests" by Charles E. Fox is an excellent popular booklet designed to present the story of forest conservation by wise use. It is prepared for use in California, and is available from the Forest Service, 630 Sansome St., San Francisco 11. Another interesting regional booklet is "The Great Southern Tree Crop", a report to the people of the South by the Southern Kraft Division of International Paper Company, Mobile 9, Alabama. It emphasizes the crop importance of southern trees.

"Ranger 'Rithmetic"

This is the title of an interesting little 10-page bulletin that will permit the mathematics teacher in the sixth grade to do a bit of conservation teaching along with her mathematics problems. It contains 22 problems, all suggested by sixth graders, and is available from the U. S. Forest Service, Washington, D. C.

Limnology

Limnological Methods. By Paul S. Welch. Philadelphia. 1948. The Blakiston Company. 381 pages. Illustrated.

This volume presents the essentials of those basic methods necessary for entry into the subject of limnology, for limnological surveys of lakes and streams, and provides fundamental information upon which specialized researches depend. The volume seeks to fill an existing gap in source material, since at present no single source of information now exists providing data on limnological methods.

For the Farmer

The Farmer's Handbook. By John M. White. Norman, Oklahoma. 1948. The University of Oklahoma Press. 440 pages. Illustrated. $4.95.

Life is full of problems for the farmer, the gardener and the raiser of livestock. This book seeks to provide concise and up-to-date solutions for these problems. It covers grain crops, legumes and grasses, fiber and oil crops, other field crops, sugar and sirup crops, garden and truck crops, orchard and vine fruits, trees on the farm, berries, beef cattle, dairy cattle, hogs, horses and mules, sheep and goats, poultry and rabbits, feeds and feeding, soil conservation, beekeeping, fish and wildlife and farm engineering.

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BIRDS AS SEED CARRIERS

When one reflects on why a fencerow comes to be lined with red cedar, sassafras, dogwood, or wild cherry, he is likely to think: "Brought there by the birds which ejected the seeds as they perched on the fence." That is correct but it is not the whole story. Similar growths spring up in fields no longer cultivated or pastured, showing that the seeds are scattered everywhere.

Those of fleshy fruits doubtless receive most aid from birds and included are the bad along with the good—poison sumacs and weed trees—as well as the more desirable kinds. And on what a scale the distribution is done—often large enough to transform old fields into woodland, and, in tracts occupied by crow roosts, to carpet the ground with tons of seeds to the acre.

Acorns and nuts are harvested for use or storage, but in the process some are dropped and others cached and forgotten. Many of these may grow and their planting is an important element in natural forestation. By this means, it is thought, heavy-fruited woody plants have their best chance of occupying new sites up-hill from the old.

If you have ever dipped your hand in water with many seeds floating on the surface, you will remember how they cling when you lift it. So they do, doubtless, to the feathers of waterfowl taking flight, thus obtaining quick transport to another place favorable for their growth. Not only seeds, but duckweeds, and small snails, and other animals profit by this means of transport. Burs also are distributed by birds but to so slight an extent that it hardly counts against their record.

Weed seeds, too, may be carried, but, as they are mostly eaten for the nourishment they contain, they are usually ground up by the birds' gizzards and do not serve to spread these plants, already too abundant for man's convenience. On the other hand the stones of fleshy fruits escape digestion by most birds taking them as the pulp is their food and the pits are ejected.

On the whole, in their seed scattering, birds benefit man, thus adding to the economic reasons which fully justify their general protection. W. L. M.

Young Naturalists

Children as Naturalists. By Margaret M. Hutchinson. New York. 1948. The Macmillan Company. 184 pages. Illustrated. $2.25.

This little book is based upon a dozen years of Nature work with British boys and girls in youth groups. It presents many practical suggestions on such work, and its ideas should, certainly, be as applicable to young naturalists in America as they were to those in Britain.

Traveling Scorpions

By Ralph W. Dexter

It is well known that the tarantulas, or banana spiders, of southern North America and Central America are frequently carried northward into temperate United States on shipments of bananas. Two records of the introduction of another type of poisonous arachnid, the scorpion, have recently been discovered in Akron, Ohio. In 1944, Mr. Charles P. Mountz found a dead scorpion, *Centrurus carolinianus,* on a window sill in a plant of the Goodyear Tire and Rubber Company at Akron. Presumably this was transported from the south, where it is common, with shipments of cotton fabrics. Such shipments usually come from Alabama and Georgia. In February, 1948, a student at Kent State University brought to our laboratories another species of a scorpion, *Centrurus gracilis,* which was discovered at Akron in a box car shipment of bananas. It was still living when collected and was kept alive in a glass jar for two weeks. This species is common in Florida. Neither species mentioned here is dangerous to man, but the poison would result in painful swelling at the locus of the sting. Modern, rapid transportation will undoubtedly extend the range of many organisms with repeated introductions, some of which may become established if brought into a favorable environment permitting them to survive, and in sufficient quantity to make reproduction possible.

Grant Elk Refuge

Safety for the last surviving herd of Roosevelt elk in California was assured by the dedication of a 1600-acre wilderness reserve in the Prairie Creek Redwoods State Park, Humboldt County, California, to be known as the Madison Grant Forest and Elk Refuge. Grant, conservationist, author and anthropologist, was a founder of the Save-the-Redwoods League, and a commemorative dinner was held to observe the thirtieth anniversary of the League and to pay tribute to Madison Grant, who died in 1937. The refuge was established as a memorial by DeForest Grant, John D. Rockefeller, Jr., Archer M. Huntington, the New York Zoological Society, the National Audubon Society, the Save-the-Redwoods League, the Boone and Crockett Club, the American Wildlife Foundation and the California State Park Commission.

Care of the Dog

Your Dog. By Josephine Z. Rine. New York, 1948. Sentinel Books, 120 pages. Illustrated. Sixty cents, paper; $1.25, cloth.

This is a new and revised edition of this practical, popular guide to the care of the dog from puppyhood to old age. At this price there is no excuse for any dog-owner not knowing how to care for his pet.

GUNS AND CIVILIZATION

As we have remarked before, W. Scott Lewis of Hollywood, California, always devotes the first page of his monthly *Mineral Bulletin* to editorial comment of a penetrating sort. In his April, 1948, issue he writes under the title "Guns and Civilization", and we quote his comments in their entirety:

"Our mail contains lots of propaganda for this thing and that. The most of it goes into the waste paper basket as we are too busy to read it all, but a pamphlet printed on expensive paper recently caught our eye and some of its statements seemed worthy of comment. It begins as follows:

" 'When your son begins teasing you for a gun he is unconsciously expressing an age-old urge, not merely for hunting and killing but for further development of civilization. The history of the invention, development and use of firearms is the story of the rise of great nations and the progress of man to modern civilization.'

"We are probably stupid but we fail to see the least connection between man's desire to kill something or somebody and any urge for the further development of civilization. We admit that it needs plenty of development but we have never subscribed to the theory that killing is the way to develop it.

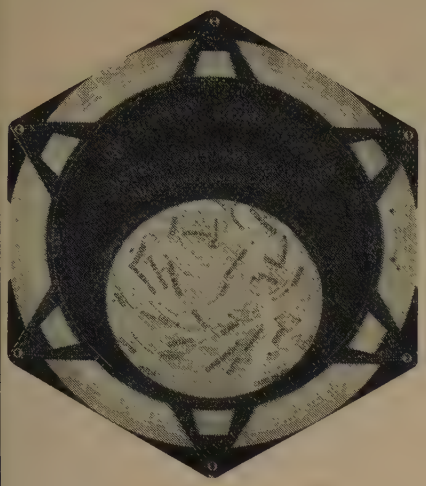
"It is true that a dictator always claims that he is working for the interest of his country, and it is equally true that he and his supporters usually try to keep themselves in power by killing those who oppose them. But that has never seemed to us to be the road to civilization.

"It is true that nations that have crushed and enslaved their neighbors have often developed a certain type of pseudo-civilization in which the outer forms were present although the spiritual values were lacking. But that hardly proves that killing advances civilization.

"If the writer had the killing of animals in mind, it will be still harder to prove his point. The hunting pressure has become so great in this country that a large number of species of birds and animals are threatened with complete destruction. Is all this shooting a sign that we are becoming more civilized? When the last whooping crane or trumpeter swan or mountain sheep falls to the bullet of some bloodthirsty killer who refuses to obey the laws passed for their protection, will it mark an advance in civilization?

"Perhaps our ideas are all wrong but we have always felt that war and the lust for killing either man or animal are vestiges of savagery. We have felt that civilization meant the exact opposite. We associate the word with peace, kindness, compassion for the weak and a desire to live in accordance with the great spiritual laws that have been established by the Supreme Ruler of the universe. That, we are sure, is the road to happiness."

Know Your Stars



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Pond Folk

Wild Folk at the Pond. By Carroll Lane Fenton. New York. 1948. The John Day Company. 127 pages. Illustrated by the Author. $2.00.

Author of many books in the field of science, every now and then Dr. Fenton takes a holiday from more serious and gives us a delightful book for the writing younger people. This is a holiday in the sense that he must take special pleasure in writing and illustrating these stories. This latest book is a companion to the earlier *Weejack and His Neighbors,* which dealt with the life of animals of fields and woods. Both stories are directed toward an audience in the four-to-twelve age bracket, but we suspect that there are many parents who will get pleasure and information from reading them to the younger group. The author brings the wild folk of the region of the pond to life without resorting to the anthropomorphic device adopted by less able and informed writers of children's Nature books.

Michigan's Island Wealth

Island Life in Lake Michigan. By Robert T. Hatt, Josselyn Van Tyne, Laurence C. Stuart, Clifford H. Pope and Arnold B. Grobman. Bloomfield Hills, Michigan. 1948. Cranbrook Institute of Science. 179 pages. Illustrated. $4.00.

This volume is a study in animal geography, dealing as it does with the mammals, birds, reptiles and amphibians found on the Lake Michigan islands that lie off the northwest shores of the Lower Peninsula. It treats, also, of the geological and cultural history of the region and the habits of the animals of the islands. The book is based upon studies sponsored jointly by the Cranbrook Institute of Science and the University of Michigan. While of interest generally to naturalists, it is also essential to anyone who may plan to visit the island region covered.

The Tale of the Trail

Tracks and Trailcraft. By Ellsworth Jaeger. New York. 1948. The Macmillan Company. 381 pages. Illustrated. $3.95.

Although there have been books on tracks and tracking in the past, no book has approached the subject in so wide and yet so integrated a manner as this fine volume by Jaeger. "Tracks", the author says, "may take us back to the earth's beginnings or give us a complete autobiography of a living animal from day to day." Recognizing this, the author starts with fossil tracks, proceeds to the Indian and his trailcraft, and then covers tracks of back-yard, barnyard, field and forest, snow, jungle and zoo, and includes the tracks of birds, amphibians, reptiles, crustaceans, mollusks and insects. He concludes the book with practical chapters on the reproduction of tracks and on tracking games. Jaeger's accompanying illustrations are excellent field guides to tracks.

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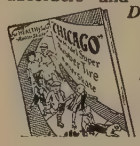

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BRADNER PUBLISHING COMPANY
ESTABLISHED 1933 DEPT. L-5, DIXON, ILL.

THE WOODHOUSE NIGHT CLUB

(Continued from page 411)

so thin he was hardly recognizable. I went to the woodhouse and sat in the chair. He entered and hopped very slowly until he reached my side, and lay there exhausted, too weak to eat or drink. I shall never forget the shock I had when I saw only a black, bloody stump close to his body where the hind leg had been. The steel trap again! Oh, that God might waken the hearts of men and women to pity and love our little wild brothers, and give them kindness, or at least a swift and decent death, instead of horrible torture. Amiel says, 'If we were truly good, all the animals would love us.' But how can they, when we kill them needlessly in the name of sport, and hideously torture them for the poor little coats God has given them against the cold? This, too, when the smaller furbearers are the farmer's best defense against the two destructive pests, insects and rodents.

"What a pure joy we miss because we do not befriend the wild creatures, not only raccoons and skunks, but many others. Near Little Falls, New York, lives a lady who for years has made pets of the beavers on her farm. They sit on her lap, and put their arms about her neck just like children. The original pair have never left her place; but each year the two young ones go away in the spring to find mates and build dams and homes of their own. And then she suffers the same anxiety I suffer in regard to my guests. The red fox also makes a fascinating pet; there is a beautiful one with which a small girl plays as safely as with a pet dog. And yet this most sensitive and intelligent of all the wild things frequently dies in the trap of burst ventricles of the heart from the excessive pain, as Christ died on the cross.

"Ever since the fur trade launched the craze for cheap, processed, native furs early in this century, when the finer furs were almost exterminated, the demand of women has been such that our woods, fields, farms and streams everywhere have become in winter the scene of millions of tiny hells. There helpless creatures chew off their own legs to escape the unendurable pain, or, unable to escape, suffer for hours, days, weeks, not only from the pressure of the trap jaws, but from freezing, fever, thirst, or gangrene, until the careless trapper comes and knocks them on the head.

"The manner of their capture has all along been purposely hidden by the trade from the women who buy the furs. During the 'Twenties, one hundred million skins were sold each year on the North American market, and the making of fur garments became a billion dollar business. No magazine, and few newspapers, dared print the facts, because of loss of advertising.

"In the same way, the egret atrocity of the late, Nineties was hidden from women by the millinery trade, until the Audubon Society made it known to the world, when, in a few years, it was abolished by Federal law.

"The vastly larger cruelty to the furbearers—largest organized cruelty of history—could soon be done away with if women would confine their buying to furs that are never trapped. Chief among these are the furs produced on the fur farms in our states and Canada, consisting of all silver fox, all mutation fox [1] and all mutation mink.[2] The natural dark mink is still largely trapped, and should never be bought without a written guarantee that it is from a fur farm. The same is true of marten fisher, beaver and chinchilla. Never trapped, also, are the furs of the hoofed animals—mouton, bonmouton, moufflon, astrakan, guanaco, vicuna, alpaca, pony, zebra, moose, caribou, reindeer, elk. The Alaskan seal is the only seal to buy, others being trapped muskrat. All cheap native furs should be shunned like poison.

"Norway, Sweden, Finland and Germany have for years had national laws against all trapping—even harmful predators in those countries cannot be trapped, but must be shot, a swift and decent death. Thank heaven a national society, Defenders of Furbearers,[3] is now organized, with headquarters in Washington. It will expose and oppose in every way the cruel trapping of fur animals. It is my hope that every woman with a spark of compassion in her, every man who loves justice and hates cruelty, will join this society."

You can imagine, now, why Aunt Sally refuses to have her name or place of residence used in broadcasts or articles; she knows too well that trappers would at once rush to the spot. She will not risk the lives of her beloved guests.

---

[1] Platinum, pearl, blue, pearlatina and others.

[2] Pastel, kohinoor, silver-blu, steel-blu, golden sable, silver sable, aleutian blue, arctic blue, etc.

[3] 1214 16th St., N.W., Washington 6, D. C.

DANCES TEACH NATURE LORE

(Continued from page 431)

tume. He carries a bow and quiver (D).

The drummer beats loudly upon his drum, and the deer come prancing into the ring in single file, the buck first, the two does next, and, last of all, the fawns (E). They leap into the air and gambol about. Sometimes they stand quietly for a few beats and then leap again (F). As the buck dances near the council ring entrance, he stiffens and stands listening, sniffing the wind (G). Then he bounds wildly to the opposite side of the ring. The does and fawns follow and all huddle together. They snort, paw the ground in fear. The buck stands protectingly in front (H).

The hunter creeps into the council ring with his bow in hand (I). He carefully stalks the deer. Then, slowly rising, he fits an imaginary arrow to his bow and slowly draws his bow string back (J), letting his arrow fly with a smack. The buck leaps high, hit by the arrow (K) and falls and the hunter gives a wild cry of triumph. The does and fawns moan and cry in terror and escape out of the ring. The hunter lifts the buck over his shoulder and carries him out (L).

Prairie Chicken Dance — This dance mimics the strange mating performance of the prairie chicken. Two dancers costumed as male prairie chickens form the cast. They wear cardboard cylinder masks with beaks and the characteristic horn-like feathers at the back of the mask (A). The bird gown, with wing sleeves, is striped in black upon gray or brown at the back and white in front (B).

The two birds dance into the ring, not too close together (C). They drum, making a pattering sound with their feet. One will run forward a few steps, head down, and make the hollow, booming sound (D). Then the other male runs a few steps and repeats the performance of the other. These are courtship demonstrations and challenges to rivals.

They approach each other, square off and rush at each other, striking viciously with their bills (E). They leap into the air facing each other, and then dance past each other, only to meet again, repeating the whole action (F). After several bouts they dance out of the ring.

The Owl Dance—In the Southwest the Indians sometimes have the owl woman and her children take part in their dances. Although she and her owlets have inspired the following short dance, it has been changed to fit the modern council ring. An older boy or girl and two small children are needed for the dancers. They wear cardboard cylinder masks painted like owl heads, and short brown cloth gowns with wing sleeves (A).

The owls hoot outside the council ring, announcing their coming, and then dance into the ring, an owlet ahead and behind the mother owl (B). They dance once around, and at the beginning of the second round face inward as they reach the cardinal points (C) in their dance. The little owlets now dance away from the mother owl, skipping happily here and there about the ring. When they get to the other side of the ring, however, they begin to feel a bit frightened, and then suddenly run to their mother across the ring. She holds out her wings protectingly, and the two run to their shelter (D). She then shoos them ahead of her out of the ring.

THE READER'S MARKET

A place where members of the American Nature Association and readers of Nature Magazine may find many interesting offerings or may advertise themselves, at low cost, for things wanted; things they have for Sale, for Trade, for Sale or Trade. This is an excellent forum for acquiring or disposing of such items as binoculars, books, cameras and photographic equipment, magazines, sports and outdoor equipment, etc.

GENERAL REQUIREMENTS APPLICABLE TO CLASSIFIED ADVERTISING

1. *Transactions based on good faith:* Transactions are based on good faith and mutual satisfaction. Deliberate misrepresentation, disregard of usual business ethics or the attempt to circumvent these general requirements, when brought to our attention, will result in refusal of further advertising.

2. *All orders subject to these conditions:* We reserve the right to edit all copy to conform with our standards and to reject or discontinue any advertisement which we consider undesirable.

3. *Who may advertise:* This department is an open market trading post. Any individual or firm whose advertisement and methods of doing business meet our requirements may advertise their goods or services.

4. *Rates:* All classified advertisements must be accompanied by remittance. The rate is 15c per word including name and address—minimum charge $2.00. Cash with order.

5. *How to count numerals etc.:* Groups of figures are counted as one word. Abbreviations consisting of initials or single characters likewise are counted as one word. Hyphenated words are counted as two words.

6. *"For Sale" ads must state prices:* A specific price must be stated on all FOR SALE ads —except that the phrase "write for catalog" may be used when listing real estate or merchandise in quantities.

7. *Conditions of trade or sale:* The condition of binoculars, cameras, instruments, other equipment useful to outdoor lovers, home-owners, etc., advertised for sale or trade must be specified as follows: PERFECT—meaning factory condition; EXCELLENT—meaning new condition, implying negligible amount of use; VERY GOOD—meaning practically new condition, implying little use, with no appreciable wear and only minor surface scratches or wear; GOOD—meaning moderate condition and with only moderate wear; FAIR—meaning no parts missing necessary to use, reasonable wear inside and out; POOR—meaning marred appearance or badly worn.

8. *Non-specific phrases barred:* Phrases such as "highest" or "top prices paid", as well as any other so-called "auction-type" phrases are not acceptable. The terms "fair price paid" or "state price wanted" may be used.

9. *Blind ads not acceptable:* Box number or blind ads will not be accepted. Give your complete name and address to insure prompt delivery of all mail or telegraph replies.

10. *Requesting privilege of examination:* Purchasers desirous of examining merchandise before acceptance should request shipment by express C. O. D. with examination privilege. This procedure permits the purchaser to inspect the merchandise in local express office and authorizes the express company to return unsatisfactory merchandise at shipper's expense.

11. The association will not accept for publication in NATURE MAGAZINE, advertisements of firearms, ammunition, or patent medicines.

12. *Responsibility for illegible copy:* Type or print advertisement plainly as we cannot be responsible for errors due to illegible writing.

13. *Closing date:* The closing date of all advertisements is the 20th of the second month preceding month of issue.

ANTIQUE GLASS FOR SALE

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PRISM BINOCULARS—Finest U. S. Gov't. optics. Huge 50mm COATED objectives. Less than half price; 7x50mm $79.50; 10x50mm $89.50; 12x50mm $92.50 plus tax, prepaid. Literature on request. DuMaurier Binocular Mfrs., Dept 89, Elmira, N.Y.

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FOR SALE, Remainder of the works of Charles J. Maynard, Ornithologist. For list of books apply to P. A. Maynard, 459 Crafts St., West Newton, Mass.

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CONIFER - LILY - RARE Seeds. Bulbs, Jade, Orchid Cactus, House Plants. Catalogue free. Ransom Seed Specialties, San Gabriel, Calif.

BUTTERFLIES

ALL DIFFERENT: 15 native moth $3.00; 15 India Papilios $3.00; 25 native Butterflies $4.00; 25 World Exotics $4.00; 10 Tropical Beetles $2.00; 10 Tropical Insects $2.00; Postage 20¢ extra. Michael's, 7415 3rd Avenue, Brooklyn 9, N. Y.

BUSINESS OPPORTUNITIES

EARN GOOD MONEY at Home! Big money-making folio contains 10 big plans you can operate, like: "Profitable Flower Business"—$975 a Year From Trees"—Order today, $1.98 postpaid. Charles Goodman, 253-A Douglas Street, Hammond, Ind.

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BEAUTIFUL USEFUL COLLIE-SHEPHERDS, pups $17. Paul Schultetus, New Liberty, Illinois.

FIELD GLASSES

TELESCOPES, BINOCULARS, Microscopes—big bargain, catalog free. Brownscope Company, 24 West 45th St., New York.

HOBBIES

HARNESSING THE EARTHWORM. At all book dealers. Author will mail a valuable free booklet on "Successful Earthworm Breeding." Thos. J. Barrett, Dept. 17, Box 488, Roscoe, Calif.

HAND POLLENIZED seeds free 4 times year. Membership New Flower Club, 12 issues interesting hobby magazine, $1.00. Everyday Hobbies, Box 1048, Highland Station, Los Angeles 42, California.

REPTILE BULLETIN five issues 25¢. New Catalogue: Pets, Hobbies, Biological Supplies, Curios 10¢. Chameleon 25¢. Pair Hamsters $2.75. Fence lizard 25¢. Turtle 35¢. Mealworms 50¢ hundred, $3.25 thousand. Quivira Specialties, Topeka, Kansas.

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4 FINE ANCIENT INDIAN Arrowheads $1.00. Stone Tomahawk $1.00. Flint Skinning Knife, 50¢. Spearhead, 50¢. Peace Pipe, $5.00. List Free. Lear's, Kirby, Arkansas.

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POEMS WANTED FOR MUSICAL SETTING. Send poems for immediate consideration. Hamann Service, 590 Manhattan Building, Milwaukee, Wisc.

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FOR SALE: Breeding mink. Our pelt grading on the New York market last year was extra, extra dark, large and silky. Write or visit, Manning Mink Farm, Canaserage, New York.

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GLASS EYES. Made in OUR factory. All kinds of Taxidermists' supplies. Complete catalog FREE. J. W. Elwood Co., 223 Elwood Bldg., Omaha, Nebraska.

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SELL IN THREE MONTHS OR MONEY BACK If you can write correct English—You can write Juveniles. I have sold some 3000-3500 stories . . . articles . . . editorials . . . serials . . . series. Now I'm teaching. "Instruction—Criticism—Collaboration." Write Dept. N for terms. Will Herman. Author of "My Juvenile Success Secrets" and "My Formula for Fiction." 5703 Broadway—Suite No. 4, Cleveland, O.

I WANT New Writers to cash hundreds of checks for $1 to $100, offered each month. The easiest way to write for pay. No previous experience necessary. Send for free details. No obligation. Saunders M. Cummings, 467-N1 Independence Building, Colorado Springs. Colo.

BOILING SPRINGS

(Continued from page 432)

flow slackens, accumulating quantities of disintegrated rock transfer the spring in time into a "mudpot"; or, if minerals obligingly lend it color, into a "paintpot." Eventually, as the mud in the vent thickens, the expiring spring becomes a mud geyser or volcano, belching forth imprisoned steam explosively at intervals. Such is the transitory life of a subterranean steam or hot water outlet from eruptive geyser, through boiling spring, to a dying paintpot or mud volcano.

Magazine Wanted

Keneth G. Young, superintendent of the Moro Public Schools, Moro, Oregon, has a hobby of collecting information about branding and branding irons. The August-September, 1944, issue of *Nature Magazine* carried an article entitled "The Natural History of Cattle Brands." That issue, like several of the wartime issues, is rare. We have none, wholly or partially destroyed, in our office. If any reader, however, has a copy he can spare, Mr. Young would certainly appreciate having it.

To Force Flowers

Commercial Flower Forcing. By Alex Laurie and D. C. Kiplinger. Philadelphia. 1948. The Blakiston Company. Fifth Edition. 550 pages. Illustrated. $4.75.

This is a standard work covering the fundamentals and their practical application to the culture of greenhouse crops. The first edition appeared in 1934, but many new developments have taken place in the interim, making a new and up-to-date edition necessary.

Important Geology Text

Sequence in Layered Rocks. By Robert R. Shrock. New York. 1948. McGraw-Hill Book Company. 507 pages. Illustrated. $7.50.

This book is written for the field geologist and directed to solving the important problem of determining the order of succession—top and bottom—and the nature of the structure in folded layered rocks. It is, of course, a volume for the advanced geologist, but is of world-wide application. Generously and expertly illustrated, it is an important and unique addition to geological literature.

Grand Canyon Plants

Plants of Grand Canyon National Park. By W. B. McDougall. Grand Canyon, Arizona. 1948. Grand Canyon Natural History Association. 126 pages. fifty cents.

This is a checklist of the plants of the park with notation of the places in which they are found, or from which they have been reported. It is not a guide to the plants for the use of the visitor, and is chiefly valuable to the botanist.

CONSTELLATION BOUNDARIES

(Continued from page 435)

now give the new boundaries of the constellations. The decision to establish new boundaries for 88 constellations covering the entire celestial sphere was painlessly brought about by means of The International Astronomical Union, which, in a period of only a few years, in which two meetings of the Union were held at three-year intervals, considered and adopted these changes and granted funds for publication of the results. Any confusion or question as to the exact position of any star in the heavens, and the constellation to which it belongs, has been eliminated by the adoption of these definitely determined boundaries.

There has been, as the result of the change of constellation boundaries, no alteration in the characteristic configurations of the various constellations, and no bright or well-known star has been displaced or removed from the constellation in which it has always been found.

During the month of October there is a dearth of bright planets in the evening sky. Early in the month Mercury is poorly placed, being very low in the west at sunset. It passes to the morning sky after inferior conjunction with the sun on October 19 and will, later in the month, be quite favorably placed for observation when it will be about 15 degrees above the eastern horizon at sunrise.

Venus is now a fine morning star as it rises several hours before the sun. It will pass close to Regulus on October 6. Mars is in Scorpio, quite near to Antares, and is so low in the southwest at sunset that it will be seen with difficulty. Jupiter is well over in the southwestern sky at sunset in Ophiuchus and it sets a few hours later. Saturn is in the morning sky a few degrees southeast of Regulus in Leo. Venus is also in Leo at this time, and the two planets will be in conjunction on October 8.

A BIRD PLAYS 'POSSUM

By JOHN M. MCBRYDE

ONE day early in March of this year I observed in Audubon Park, New Orleans, a small group of male purple martins just returned from their winter sojourn in South America. Their fresh, steel-blue coats glinted in the sunshine as they skimmed the tops of the grass, following a regular route in an ellipse of about a half-mile in diameter. It was fascinating to watch the swift circling of the birds, steadily keeping their course, one after another like performers in a circus ring.

As I stood there lost in admiration, a gentleman joined me, bringing on a leash a handsome young English setter. Stopping near me he loosed his dog, who at first frisked about at random, then, as the circling martins swept close by us, suddenly gave chase to the nearest one, following it around the whole course, the bird, in tantalizing fashion, keeping only a few feet above his head. At the far end of the ellipse the bird appeared no more than a speck against the horizon, while I could clearly discern the full outline of the dog persistently following its flight.

When they again came near to where I was standing, the martin, to my astonishment, suddenly dropped to the ground, and, for about a minute, lay on the grass in a little black heap as if brought down by a gun. Catching the scent, the dog, instead of rushing forward to seize his prey, came to a point and stood immovable until the bird rose on wing, and the race was on again.

Another lap they made over approximately the same course, with the dog at times dropping slightly behind. Returning to the spot where they started, the martin once more fell to the earth, and the dog, eagerly crouching, again came to a point. After a brief interval the martin rose on wing and wheeled around the same course, followed by the panting dog. This time, however, his master called him off and led him, reluctant, away.

Puzzled at first by the surprising action of the bird in falling to the ground in such a dramatic manner, I concluded, after a few moments' reflection, that the martin was trying to deceive the dog by feigning death, an artifice made widely known through the common practice of the 'possum to play dead, employed also by various insects and beetles, by the hog-nosed snake and by the toad. It is recorded, also, by W. H. Hudson, of the common partridge in Argentina, and, even more remarkable yet, in England the soaring skylark is said upon occasion to resort to the same ruse.

As the martin, however, so long as he remained in the air, was not at any time in imminent danger from the dog, the desperate trick, in which he risked his life, served no manifest purpose and must have been wholly automatic, caused by the persistent pursuit of the dog. And the action of the setter in becoming rigid at sight of the motionless bird on the ground was, in like manner, instinctive, for the martin lay actually within his grasp.

Although I have frequently observed a parent partridge, or a dove, in order to lure away an intruder from its nest, flutter along the ground as if wounded, never before have I seen such an apparently premeditated act as that of the martin.

LET'S GO NUTTING

Answers: 1. Brazil nut; 2. butternut; 3. beechnut; 4. peanut; 5. chestnut; 6. coconut; 7. hazelnut; 8. nutmeg; 9. cashew nut; 10. hickory; 11. almond; 12. walnut; 13. acorn.

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Under the Microscope

By JULIAN D. CORRINGTON

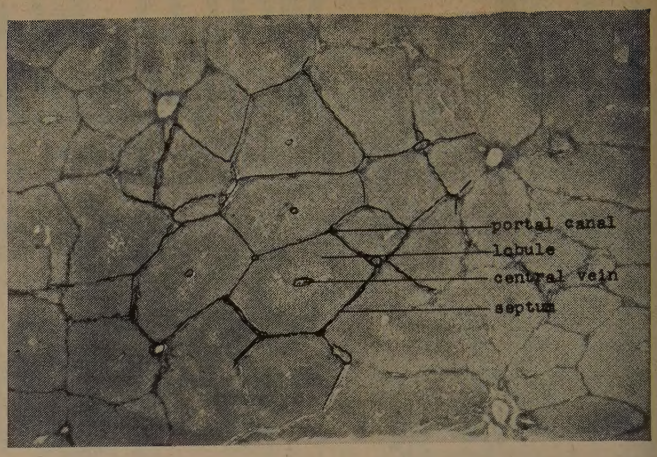
LIVER—GLAND OF ALL WORK

THEY say if you want to get a job done, give it to a busy man. By the same logic, if there should be a new function essential to the body, the liver would certainly draw the assignment.

In former days, when functions of organs were mostly unknown, the liver was supposed to be the seat of sundry powers or emotions—as love, bravery, or its opposite—cowardice (white-livered). It was the seat of the "soul"; it produced "natural spirits"; bile was one of the four "humors" (*bilious* formerly meant choleric or ill-tempered); the liver was the "guardian of the heart." But even in times when mysticism of this sort clouded all science, we find Galen, the great physician of antiquity, hitting about as near to the truth as was possible for his day when he stated that the liver received food from the digestive tract and converted it into blood.

When histology was added to the family of biological sciences in the middle of the past century, the nature of the liver as a *gland* was emphasized. This great organ, the largest in the body, is an exocrine or duct gland, with a dendritic or treelike branching of the hepatic duct to bring bile from all over the liver for storage in the gall bladder until needed for emulsifying fats. Others pointed out the unique circulation scheme of the liver and eventually an even more basic function was established—that of the storage of carbohydrate food in the form of glycogen, or animal starch. Thus the liver is the granary of the body, receiving sugar in large shipments, storing it in the dehydrated form of starch, then doling it out as needed between meals.

But these two functions, important as they are, only begin the list. In embryonic life the liver is the chief manufacturer of blood (hemopoietic organ), a task later taken over by the bone marrow. Assisting the spleen, the adult liver filters the blood, extracting worn-out red blood corpuscles and fragments thereof, bacteria, and foreign bodies in general. The principal organic excretion of the body, urea, is manufactured in the liver and sent via the bloodstream to the kidneys for elimination. Hence the liver is an endocrine (ductless) gland in addition, although urea would not be classed as a hormone. The liver plays an essential role in the metabolism of fats and proteins, builds up proteins, and stores a great many substances besides glycogen—



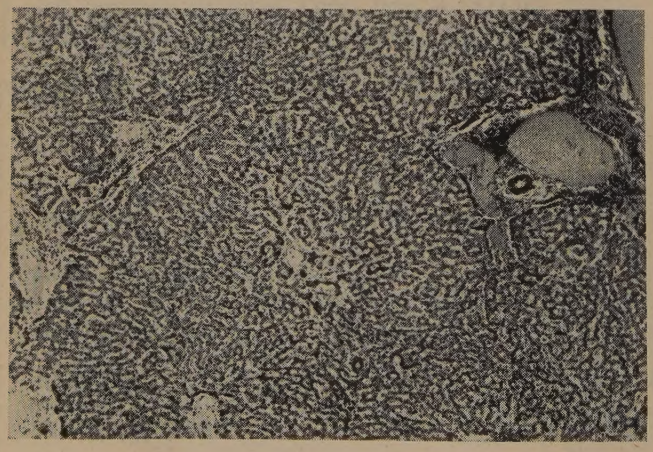
Cross section of pig liver, 15X.

one of which is the tremendously important anti-pernicious-anemia factor, made in the stomach.

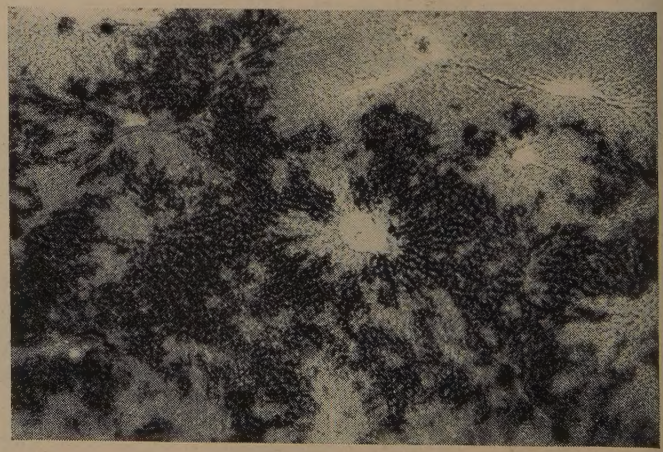
The liver also manufactures fibrinogen, essential in clotting of the blood. Still another job for this overworked organ is the excretion of bile pigments. Calculations show that something like ten million worn-out red blood corpuscles are removed from circulation in the average human body every second, the spleen and liver being the principal sites for this wholesale demise. The hemoglobin of each red cell breaks down into a protein portion and a nonprotein portion, the latter being hematin, which contains iron. Much of this hematin is excreted by the liver as bile pigments, which pass through the bile duct and thence out through the intestinal tract. The iron fraction is saved and used again.

Heparin, an anticoagulant, is yet another liver product, and it is likely that prothrombin, a substance that, with fibrinogen, plays a part in the opposite action, clotting, is another. It is thus evident that the liver takes care of most of the tasks concerned with metabolism, and the policing and clotting of the blood, and it is not likely that all functions of this great organ have been discovered to date. Certainly the separate duties reach a very large number and it is no wonder that former generations of scientists were unable to state the "function" of the liver. Small wonder, too, that cirrhosis or hardening of this organ, as from chronic alcoholism, is a serious and eventually fatal condition. Hail the liver, gland of all work! Emulate the example of ancient people and erect a shrine whereon reposes an enlarged model of the liver! Kotow and salaam! Our poor old hard-worked livers rate this distinction and homage.

However, the most wonderful part of this tale remains to be disclosed. In every other organ having specific duties and products, the histologist and physiologist have been able to correlate structure and function. They find specialized cells, subject for dissection; a portion of the liver (or other organ)



Human liver, 40X



Human liver, Golgi, bile capillaries black, 40X

adapted to perform specialized tasks: alveolar cells in the pancreas manufacture digestive enzymes, while the island cells produce insulin; in the stomach, chief cells elaborate pepsin, parietal cells hydrochloric acid, or its forerunner. But the liver is composed of *cells that are all alike!* Billions of them are present, yet, in spite of the great size of this organ, a hepatic cell from one portion appears to be just like any other hepatic cell, from any other location. In the face of the manifold and complex labors of the liver, this seems impossible, and has caused no end of sweat, brain waves, and tears on the part of many an investigator.

The microscopist customarily makes a single kind of preparation for most of his specimens, but with the liver he can have a field day. In fact, if this viscus (the uncommon singular of the word *viscera*) is to be studied at all intensively, there should be at least five or six different sorts of slides available.

From the local abattoir one obtains a fresh piece of pig liver, trims it for cutting cross sections, and puts it through a routine technique, such as fixing in Zenker's fluid and staining in hematoxylin and eosin. A Mallory triple or a hematoxylin and picrofuchsin (van Gieson) are much better for this subject, since they are specific for connective tissue. As seen in an accompanying illustration, such a slide shows numerous *lobules,* more or less hexagonal in outline, and separated from one another by *septa* of connective tissue. By contrast, the human liver (shown in another photomicro) is deficient in connective tissue, the lobules blending somewhat into their neighbors. Thus the purpose of the pig-liver slide is to emphasize the architectural plan of the vertebrate liver. A human-liver slide illustrates the more usual construction, but if the microscopist cannot obtain human tissues, he may substitute cat or rodents.

The lobule is a circulatory unit, not a glandular one. Ideally there should be six *portal canals,* one at each angle of the hexagon, for each lobule, but their actual distribution is far less regular. Each such canal, as seen in a cross section, is an island of connective tissue in the human liver, or the confluence of several septa in the pig, at the corners of adjacent lobules, where three meet. This tissue is a part of *Glisson's capsule,* actually an ingrowth from the connective tissue surrounding the portal vein, and encloses four kinds of structures—branches of the hepatic artery, of the hepatic portal vein, lymph vessels, and one of the finer divisions of the bile duct. The four are readily told apart—the bile duct is lined by a low cuboidal epithelium the cells of which are predominantly nuclei, hence staining deeply with hematoxylin; the three vessels are lined by characteristic endothelium, exceedingly thin, with small, dense, black, bulging nuclei here and there; the vein is very much larger than the artery or lymphatic; the artery much thicker-walled than the other vessels. Often the section passes through a level where branching is occurring, and so there may be two of any one or more of these conduits. Lymphatics are abundant in this connective tissue and may be numerous, although always inconspicuous, in any section. At certain levels, any of these structures may be sliced tangentially or even longitudinally, or some of the larger ducts or vessels may be seen in the section interrupting the outlines of lobules.

The main *hepatic artery* is smaller than would be expected for so large an organ, and the reason becomes apparent when one learns that only 25 percent of the blood going to the liver arrives, at high pressure, over this artery. The other 75 percent, flowing more leisurely, at low pressure, enters via the hepatic portal vein. The artery branches repeatedly, as is customary, supplying mainly the septa, ending in capillaries that join the portal system. Unlike most organs, the chief blood supply going to the liver arrives in a vein; or, to put it another way, the liver interrupts the course of a large vein, the *hepatic portal,* the blood being spilled out into numberless wide but thin-walled spaces, the *sinusoids,* then gathered again and carried on and out by a pair of *hepatic veins.* Such a construction is termed a portal system. The hepatic portal vein results from the union of venous channels from the abdominal viscera, as the intestine, pancreas, and spleen, and is thus the highroad of digested foods, other than fats, on their way from intestine to body. The liver gets first whack at them and what it does is of vital importance to the whole economy of life.

The route may be seen in any hepatic lobule. Blood, laden with recently absorbed food, comes in over a number of branches of the portal vein. Each such branch, lying in a portal canal, will border several lobules, ideally three, and will send some of its blood into each. Thus a single lobule, as seen in cross section, might receive venous blood from all six of its corners. This blood flows radially toward the center of the lobule, through the many sinusoids, which appear as white spaces seen between cords of cells. At the middle of the lobule is the *central vein,* that begins the series of vessels leading out through the hepatic veins to the post-cava and thence to the heart. The hepatic portal vein, together with its many subdivisions, is the afferent (conducting toward) vein of the liver; the hepatic veins, with their numerous tributaries, are the efferent (leading out or away from) veins.

When injecting the blood system of a specimen for anatomical study, the hepatic portal system must receive a separate injection; for example, arteries red, systemic veins (all those other than portal) blue, and hepatic portal yellow latex. The usual gross injections will not pass through the sinusoids of the liver. When properly prepared, such a specimen not only makes a splendid and instructive

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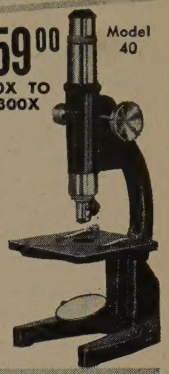

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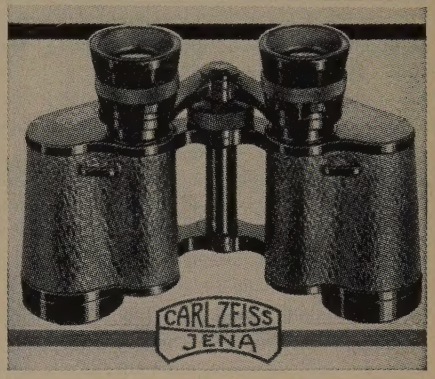

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subject for dissection; a portion of the liver (or other organ) can be sectioned as usual and stained with hematoxylin and eosin, neither of which is too near in hue to the colors of the injection masses as to cause any confusion. A slide of injected liver is practically a must in studying this organ.

The endothelial lining of the sinusoids is in contact with the liver cells or *hepatic cells* themselves. These are arranged in radiating cords called *trabeculae* (sing., *trabecula*, a little beam). The combined trabeculae constitute the *parenchyma*, or essential tissue of the liver, and it is these monotonously similar hepatic cells that presumably perform all of the manifold functions previously listed. except that of phagocytosis, next to be described. Typically the cells occur as double rows, bordered by a sinusoid on each side, and with a minute branch of the bile duct system in the center, between the two cells, and requiring special methods to render visible.

Endothelial cells line the sinusoids, but are not the same as those found in bloodvessels elsewhere. Various transition stages can be noted, from the undifferentiated lining cell up to the fully formed *Kupffer cell*, which is much larger, stellate (star-shaped), and projects into the sinusoid. This cell is classed as a *macrophage* (big-eater) or *histiocyte* (tissue-cell, a very poor name) of which there are many sorts in the body. They are all described as *phagocytic* (I eat-cell), indicating that they form pseudopodia, like an amœba, and ingest particulate matter of almost any kind, such as old or broken down red blood corpuscles, hemoglobin derivatives of the same, or bacteria. It is by means of the Kupffer cells that the liver acts to purify the blood, a function shared with the spleen. Whether or not this cell is the same, or only similar to, other macrophages found in the connective tissues or the blood is still disputable.

A laboratory mammal may be injected with a solution containing finely divided particles; for example, a vital dye, as trypan blue or neutral red, or a suspension of carmine, or—probably simplest to prepare—India ink, which contains very minute carbon particles. After several hours, the animal is killed and slides prepared of the liver in the usual way. The Kupffer cells will be found to have taken up large quantities of the colored particles.

The hepatic cells do not absorb many of these objects, but their role in storing carbohydrate food in the form of glycogen can readily be demonstrated by using a glycogen stain, the favorite being Best's carmine method. This technique yields blue nuclei and bright red glycogen.

Still another preparation is a Golgi slide to demonstrate *bile capillaries*. This bichromate-silver nitrate technique is tedious and advanced, but provides an instructive slide, as shown by an accompanying illustration. The bile flows in a direction through the lobule opposite to that of the blood—from center to the periphery—the fine canaliculi beginning near a central vein and, after traversing a trabecula, entering one of the interlobular bile ducts in the portal canals. Thus, if this function of bile secretion were to be regarded as primary, as embryonic development of the liver indicates, then the functional "lobule" would have a portal canal as its center, surrounded by three central veins.

Owing to the complete development of Glisson's capsule in the pig and a few other mammals, a single lobule can be isolated from its neighbors or studied in its several aspects and dimensions. Enlarged wax reconstructions have been made of the pig-liver lobule, found to be a short cylinder, variable in size and shape, and to number 702,000 in the average specimen (Johnson). Since each lobule contains a very large number of sinusoids and is traversed or bordered by various larger blood vessels, the total capacity of the vascular system of the liver is enormous. One investigator computed that, in anaphylactic shock in a dog, as much as 61 percent of the total quantity of blood in the body was stored in the liver! This is extreme, of course, but normally the liver exhibits alternations of a *storage phase* with a *non-storage phase* with reference to the amount of blood in the sinusoids. The liver also exhibits an alternation of an *assimilatory phase*, following eating, in which the hepatic cells show large amounts of glycogen, fat droplets, and/or proteins, according to diet, with a *secretory phase* in which bile is preponderant.

In addition to the slide preparations mentioned thus far, the liver is a favorite subject for demonstration of *reticular tissue*, a special form of connective tissue that acts as a skeletal framework for numerous soft organs of the body. Silver nitrate is used to blacken this tissue by impregnation. *Mitochondria* or *chondriosomes* are granules, rods, or filaments that occur within the cytoplasm of cells, as does also the *internal reticular apparatus* or *Golgi apparatus*, a network; the function of neither is understood, both require special techniques, and both find their best display in the liver cells. By microchemical methods, sections of liver yield demonstrations of fats and proteins as well as glycogen. Indeed, the number of useful microscopic preparations that can be made from the liver is exceeded only by the manifold functions of that well-known, enigmatic organ.

BEGINNER'S PRIMER

Our parting remark concerning flies of the Family Phoridae, in a preceding installment, was that in certain species the females were wingless or had greatly reduced wings, and lived in the nests of ants or termites. This brings to attention a peculiar relationship, exemplified by species of many other fly families as well as by phorids.

An animal that makes its home in the nest or burrow of some other species of animal is termed an *inquiline* (L., a tenant or lodger). Often the guest does the host no harm, receiving merely shelter, perhaps protection from enemies of the outer world, and possibly some of the leftover food. These guests are then also termed *commensals* (L., with-table; one who eats at the same table), and many are the insects that dwell with termites *(termitophilous)* or with ants *(myrmecophilous)*.

It must be exceedingly easy, however, for many commensals to slip over the line into parasitism. Once established as an ignored or even an accepted inquiline, a phorid fly larva could depend more and more on the host's food, becoming a social or economic parasite, an insect panhandler. Being predacious, the next step would be to devour dead hosts or their larvae or pupae, acting as scavengers, and then to attack living hosts, becoming an outright predator. If the relationship takes this turn, it is likely that the inquiline species would soon become recognized as a dangerous enemy, and thereafter it would be killed on sight or barred from access to the nest.

If the fly larva stops at the scavenging stage, then it is performing a useful work for the host species and is encouraged, even protected and assisted, and advances to the state of *symbiont* (together-life). A third route that may be followed, however, is a common one in these families of flies: the female inquiline may lay her eggs on or in the bodies of adult or larval hosts. When the guest larva hatches it then devours the host. Many of these graded stages of transition from complete independence to complete internal parasitism are shown by phorid flies.

Several other families of flies seem to consist exclusively of minute termite guests, some so modified that they bear no resemblance to flies. This series in the Diptera ends with one of the most aberrant of all insects, the bee louse, *Braula cæca*, an ectoparasite of the honeybee, and of such interest to the microscopist as to be reserved for discussion in a feature article on some future occasion.

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